CURVED MONITORS ON TEST
WHICH IS WORTH YOUR CASH?

micro mart
Computing in the know

Plus

• How To Copyright And Trademark Your Content Online
• Prevent Pop-up Ads From Plaguing Your Web Browsing
• Factory Resetting A Laptop In A Few Easy Steps

SUPERCHARGE YOUR COMPUTER

20 ESSENTIAL SPEED-UP TIPS

PERFORMANCE SOFTWARE IN FOCUS

HOW TO MAKE WINDOWS FASTER

WATER COOLING AND OVERCLOCKING

AND MUCH MORE!

![CCL logo]

Find Your Perfect Monitor
at CCL

FREE Courier Delivery

Competitive Prices

Massive Selection to Choose From

AMD FreeSync™ Monitors

FREE P&P

AMD FREESYNC TECHNOLOGY

AOC G2460VQ6 24"

£113.97

1920 x 1080 – 1ms Response Time
AMD FreeSync Support – VGA, HDMI, DP

FREE P&P

27" iiyama
G-MASTER GE2788HS
BLACK HAWK
1ms

AMD FREESYNC TECHNOLOGY

iiyama Black Hawk 27"

£149.99

1920 x 1080 – 1ms Response Time
AMD FreeSync Support – DVI, HDMI, DP

FREE P&P

28" iiyama
G-MASTER
GOLD PHOENIX
1ms 4K

AMD FREESYNC TECHNOLOGY
4K

iiyama Gold Phoenix 28"

£309.99

3840 x 2160 – 1ms Response Time
AMD FreeSync Support – VGA, HDMI, DP

Ultra Wide Gaming Monitors

FREE P&P

AMD FREESYNC TECHNOLOGY

LG 34UM68 34" UltraWide

£349.98

2560 x 1080 – 5ms Response Time
AMD FreeSync Support – HDMI, DP

FREE P&P

NVIDIA G-SYNC

Acer Predator Z35 35" Curved

£599.99

2560 x 1080 – 4ms Response Time
NVIDIA G-Sync Support – HDMI, DP

FREE P&P

NVIDIA G-SYNC

ASUS PG348Q 34" Curved

£999.99

3440 x 1440 – 5ms Response Time
NVIDIA G-Sync Support – HDMI, DP

Many more great monitor deals and offers online www.cclonline.com

call: 08000 50 10 10

visit: **www.cclonline.com**   email: **pcsales@cclonline.com**
find us: CCL Computers Ltd, Inmoor Road
Off Cross Lane, Bradford, BD11 2PS

Prices correct at time of going to publishing (4th August 2016). Images & designs are for illustrative purposes only. Please call for details.

![CCL logo]

Contents
This week...

08
20 Speed-up Tips

18
How To Make Windows 10 Faster

24
The Water Cooling Guide

30 How Does Overclocking Work?

36 Penny Pinching Apps

Also In This Issue...

Group Test

20 WAYS TO SPEED UP YOUR PC

When your computer's get-up-and-go has got up and gone, here's how to get it back again…

There's barely a person out there who doesn't think that their PC could do with a little tweaking here and there to get it faster. But maybe you've tried everything you think is obvious. That's why we've put together a list of 20 tips and tweaks that'll speed up your PC. You might have tried some things on our list, but not everything!

1 Get Your Cables In Order

The inside of a computer can quickly get messy and tangled, and dangling cables restrict airflow and collect dust. In a worst case scenario they might even slip inside fans or heatsinks, impeding their efficiency. It all impacts performance.

To prevent that, you can neaten up your cables. Get a set of cable ties, and group power and data cables into bundles. If your case has the necessary fixtures, you can even tie them so they run clean against the case's exterior where they're as discrete as possible.

2 Seat Your RAM Correctly

Ordering RAM correctly is important for achieving the best performance. Single (unpaired) RAM modules should always order them from highest-capacity to lowest, starting with the lowest-numbered bank.

But if you're using a pair of dual-channel modules (and most modern systems are), then you should always keep them paired up. Most banks are paired alternately, meaning if you have four banks, then the paired slots will be numbered 0 and 2, and 1 and 3. Most motherboards make sure paired slots have the same colours, so you can easily see which ones you should be using.

3 Make Space Between Your Components

The reason RAM banks are paired is to leave space around individual modules, which brings us to another point. When you're building a PC, there's no rule that says you have to clump your hardware together. Indeed, it's better not to.

Leaving gaps between hard drives, SSDs, optical drives or expansion cards will give the heat generated by components more space to dissipate without negatively affecting their neighbours. The colder components are, the better their performance and the longer their lifespan, so there's no real downside to keeping them as far from one another as you can.

4 Upgrade Firmware On Old Components

Installing new firmware isn't the simplest process, but it's usually worth doing if your hardware is starting to feel its age. On things like optical drives and routers, new firmware can add features, iron out bugs and improve compatibility.

Firmware downloads are normally available from the manufacturer's website, and updating your components tends to be a fairly simple process, which can be accomplished using a small applet, which you'll find bundled with the download.

Firmware flashing isn't for novice users; improper application could turn your hardware into little more than decorative pieces, but it's always worth investigating.

5 Position Fans For Maximum Airflow

If you have a separate exhaust fan to install, don't just shove it anywhere. Try to think about what the air inside your PC will be doing when all its fans are switched on.

For example, if you put an exhaust fan below the graphics card, it might counteract the graphics card's fan, rather than help it. Ideally, you want the exhaust fan positioned at the top of the case (where warm air collects), with all of the other fans blowing towards it. If you have two, devise a system that ensures they're sucking air from different places. Good airflow keeps systems cool and efficient, so take care to manage where fans draw air from.

6 Install Fan Filters

When dust builds up on hardware, it not only insulates that, it also reduces the efficiency of existing cooling measures like fans and heatsinks, so it's worth keeping your system's interior as clean as possible.

We can therefore say that adding fan and case vent filters to your system is probably a smart upgrade to make for your system, and if

you've ever had a look at the thick carpet of dust inside even relatively young PCs, you'll understand why. They're cheap to buy, easy to install and remove, and the filters are washable for easy cleaning.

7 Disable Unwanted Devices

You can speed up your boot times by switching off peripherals that you don't want to use. Enter Device Manager, find the hardware you don't want to be accessible (for example, an on-board network controller that you've replaced with a more powerful network card), and simply select 'disable' from the right-click context menu. This will prevent the drivers being loaded and treat the hardware as if it doesn't exist until such time as you re-enable it.

Just remember not to disable anything unless you're sure you know what it does. Disabling a crucial piece of hardware could prove disastrous for your system's ability to operate!

8 Disable Acoustic Mode

Recognising that some people get annoyed by loud hard drive noise, some BIOSs have special low-noise modes, which prevent mechanical hard drives from making a lot of noise. Unfortunately, it does this by preventing them from

spinning up to full speed, which slows down your access times and prevents applications from launching as fast as they could.

If you want to make sure acoustic mode isn't enabled, you'll have to look around your BIOS. The exact location varies, but it'll probably be in a storage option or performance menu. When you find it, you want to make sure the option is set to 'performance' or 'high-speed', rather than 'quiet'.

9 Install New Graphics Card Drivers

The graphics card is the most important thing in any gaming system, so it really pays to keep it in good shape. That means making sure you have the right drivers installed so games can take full advantage. Older and out-of-date drivers – even if they're only a couple of weeks old – can mean the latest titles aren't getting the power they deserve.

We're not talking a trivial amount here either. A simple graphics card driver update has been known to improve performance by up to 70%. It's usually a lot less than that, admittedly, but it almost never goes the other way – and even if it does, rolling back drivers is easy. There's virtually no reason not to have the latest ones installed.

10 Clear Out Your Hard Drive

If you have a mechanical hard drive that's almost full and increasingly fragmented, you'll see a performance drop represented quite directly in how your system runs. Defragmentation fixes that.

The first thing to do is make sure your drive has plenty of free space available. If at all possible, make sure it has at least 20% of its space unused (but the more, the better). Then run a full defrag on it. Defragging a drive will order the contents so free space is kept together, making it faster to read and write from, which means games and applications won't be as badly held up by drive access times.

11 Kill Background Processes and Software

As an operating system, Windows is particularly bad for allowing programs to run stuff in the background without letting you know. Sometimes every program you install seems to think it needs a helper app running at all times. It doesn't take long before they stack up and start to grind your system down.

To see your background services, you can press Ctrl+Alt+Del and look at the process manager (you may

need to Google the names of some to see if they're needed) to see what's running so you can uninstall any you don't want, and you can also look at your list of background services in the control panel and turn off any that you know you don't need.

12 Overclock Your Graphics Card

Overclocking your CPU, RAM or GPU is almost certain to improve performance, but it can be intimidating – especially if you're worried about having to apply extra cooling.

But even a small overclock might be worth trying out if you have a normal cooler that's in good condition. Overclocking the CPU and RAM usually requires BIOS tweaks, which feel serious, but graphics drivers often allow overclocking in software, so you can increment the card's speeds in 5% jumps and perform stress-testing benchmarks after each turn to test stability.

Remember that overclocking can damage your hardware, so it's done at your own risk and will almost certainly shorten the lifespan of your components!

13 Upgrade Your Processors

How old is your current graphics card? Or CPU? If the answer is more than a couple of years, then chances are that even the mid-price hardware on the market is capable of running yours into the ground. This means it's time for an upgrade.

Hardware upgrades can be an expensive way to get a performance hike, but if you can upgrade without replacing your motherboard, it's actually not too pricey. You should be looking for around a 25%-50% improvement when upgrading if you want your hardware to tide you over for another couple of years, so budget around £100-£150.

14 Install A New SSD

If cleaning up your existing drive isn't practical, you could spend some money on a new one instead. And if you don't have an SSD, you're overdue an upgrade.

SSDs are extremely fast and effectively remove any storage-based bottlenecks that you might experience while using your PC. They're also cheaper than a CPU or graphics card upgrade. While the performance hike isn't likely to be as big as those upgrades might offer, you should see a notable improvement – especially if the hardware bottleneck is coming from your hard drive.

15 Disable Superfetch and Prefetch

Superfetch and Prefetch are services designed to reduce application loading times, but they're only intended for use with mechanical hard drives. If you're running an SSD, they're actually just getting in the way of smooth operation.

To switch them off, go into the services area of your control panel and find the entry for 'Superfetch'. Set it to disabled (or manual) so it stops running automatically.

Disabling Prefetch is a little trickier – open regedit and navigate to the key ' HKEY_LOCAL_MACHINE\

SYSTEM\CurrentControlSet\ Control\Session Manager\Memory Management\PrefetchParameters'. Double-click on 'EnablePrefetcher' in the right-hand panel, and then change the 'Value Data' to '0' (the default setting is '3').

16 Disable Graphics Vsync

On all graphics cards, you'll find a setting known as 'Vsync'. This refers to 'Vertical Sync' and means making sure your graphics card sends an update synchronously with your monitor's refresh rate.

Disabling Vsync can lead to a visual phenomenon known as 'tearing', where the problem is essentially that your screen has updated while only half of the image was drawn in the graphics card. But it also means that games have a slightly faster frame-rate, because they're always churning through the next frame, not waiting for the monitor to update.

17 Put Your SSD In AHCI Mode

Not all SSDs are configured correctly, and sometimes

AHCI will be disabled when it shouldn't be. AHCI allows your SSD to take advantage of Native Command Queuing, which is a SATA-specific technology that stops larger, slow tasks holding up smaller, fast ones.

To check it, open the Windows device manager and look for the tree entry marked 'IDE ATA/ATAPI controllers'. Expand it, and see if one lists AHCI. If it doesn't, your system isn't in AHCI mode. Note that this might be because you only have mechanical hard drives, in which case it's fine!

If you have an SSD and want to switch AHCI on, use Regedit to change the following values to '0':

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Msahci

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\IastorV

You can then enter the BIOS and set your SATA mode to AHCI to complete the process.

18 Make Sure TRIM Is Enabled

Another SSD tweak is to make sure that TRIM is enabled. Trim commands allow an SSD to delete unwanted data in a way that doesn't impact performance. For years, operating systems were optimised for mechanical drives, and deleting data the same way results in a cumulative performance hit as the drive's free space fills up with junk.

To check TRIM, you need to run the command line with administrator privileges (type 'cmd' in the search box, then right-click it and select 'run as administrator'), and then type the following command:

Fsutil behavior query DisableDeleteNotify

If the value returned is 0, TRIM is enabled. If the value is 1, TRIM is disabled. If you get the latter result (and remember, this only applies if you have an SSD), then type the following command to turn it on

fsutil behavior set DisableDeleteNotify 0

19 Move The Pagefile

If you have two drives that are the same speed, store the pagefile on the drive you use the least. This will ensure that your system's resources are shared more evenly; you can run a program or game off one drive while the other is reading and writing to virtual memory, meaning neither operation gets interrupted by the other.

To move your pagefile, click on the Start Menu, type 'Advanced System Settings' in the search box and click 'View advanced system settings'. Under the 'Advanced' tab, find the section called 'Performance' and click 'Settings.' Again, under the 'Advanced' tab, find the 'Virtual Memory' section and click 'Change…'

Here, you can uncheck 'Automatically manage paging file size for all drives', then choose another drive for the pagefile to go on. You'll need at least as much space as you have RAM – so 4GB of space for 4GB of RAM. Once you've done this, Click 'set', then completely remove the pagefile from the original location (usually C drive). Click OK to exit on each dialogue until prompted to reboot, then do so.

20 Change The Power Plan

In modern versions of Windows, the default performance plan is 'Balanced', meaning the hardware will make sure your PC runs well without sucking up your electricity bill or battery charge. If, however, you don't care about shaving pennies off your bill (or your laptop is plugged into the mains) you can visit 'Power Options' in Control Panel and select 'High Performance' to keep your hardware running at its best regardless of how much power is available. **mm**

23" HP LA2306X Full-HD LCD Monitor

SAVE £54

➤ 1920 x 1080 Full-HD
➤ 1Mill:1 Dynamic Contrast Ratio
➤ 2x USB 2.0 Ports
➤ 5ms Response Time
➤ VGA, DVI & DisplayPort Connections

WAS £113.95 Inc.VAT

£59.95 inc.VAT

Quick Code #66488

* Web Only Orders (Limited Stock)

Gigabyte GTX 950 XTREME GAMING
Core MHz: 1203 (1405 Boost) / 2GB / DVI, HDMI, DP

SAVE £36

Web Only Orders (Limited Stock)

WAS £155.95 Inc.VAT

Quick Code #65901 **£119.95** inc.VAT

Kensington 2.4Amp Charger
Fast Charger for IPhone, Ipad, Ipod Touch / Nano

SAVE £14
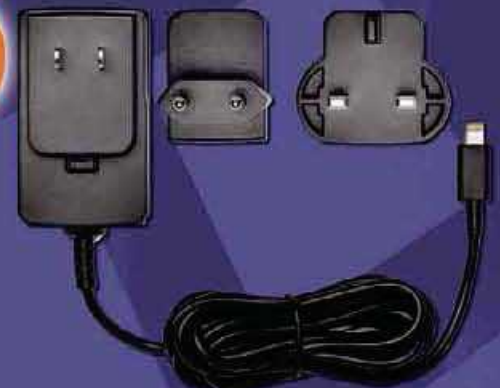
Web Only Orders (Limited Stock)

WAS £19.49 Inc.VAT

Quick Code #66123 **£5.49** inc.VAT

CALL
0161 248 1611
Mon - Fri 9am - 5:30pm

CLICK
www.aria.co.uk
Order online 24/7

VISIT OUR SHOP
More Great Deals!
Manchester M12 4AS

PERFORMANCE
SOFTWARE TOOLS

Getting the best from your system means knowing how it's performing

I f you want to get your PC running as fast as possible you can't just play it by ear, you need to benchmark and test then pin your hardware to its maximum capabilities. It's not just a process for speed freaks, though. Finding ways to use hardware more effectively is an essential part of maintaining any system, and that's why we've put together this list of essential benchmarking tools to help you tweak and improve your system.

BootRacer 6.0
www.greatis.com/bootracer
A slow-down in Windows' boot speed is one of the most difficult problems to explain and repair because causes can be varied and unintuitive. If you want to track the effects that various settings, configurations and installations might have on your system's boot time, you need a program like BootRacer.

Rather than try and make you figure out what's slowing your system, BootRacer provides constant monitoring of boot times so you see when something has affected it as soon as that happens. It's compatible with multiple versions of Windows, from Windows 2000 and XP right up to Windows 10, and can be downloaded from its website or through the Windows store. In both cases it's free for non-commercial use, and the requirements are minuscule – less than 10MB of disk space.

Once installed, BootRacer tracks your boot time and displays it after each launch – with its own impact on a system being negligible. While it doesn't have a huge range of features, it does focus well on its main task – boot time calculations automatically exclude any password timeouts, ensuring accurate and useful reportage of the Total Boot Time, and the details are logged to both its own 'History Report' and the standard Windows Event Log, so you can check them however you prefer. It's undeniably basic, but it's designed to be an analysis tool rather than help you speed up your boot times.

PassMark PerformanceTest 8.0
www.passmark.com/products/pt.htm
PassMark PerformanceTest is a whole suite of tools designed to thoroughly benchmark every major aspect of a PC's performance. It's fast, easy to use and configure, and boasts a huge range of tests that give

BootRacer 6.0

clear, objective results which can be easily compared with other users.

We're not exaggerating when we say it tests almost everything. There are five benchmarking profiles, which run thirty-two separate tests between them, as well as seven 'advanced testing' windows for running custom benchmarks. As well as 2D graphics, 3D graphics and CPU operations, it also evaluates disks, memory and more obscure things like CD/DVD performance and network speeds – even the physics performance of your graphics card gets a workover.

Results can be aggregated into a single PassMark Rating you can compare with similar systems, while a built-in 'baseline' result allows you to see how your system performs against a fictional average build. You can also save your latest results as the new baseline in case you want to try out some tweaks or check the performance increase caused by an upgrade.

With so much going on, it's probably not much of a surprise to learn that it all comes with a cost – after the 30-day evaluation period, it will cost you $27, which isn't going to break the bank. If you only want to use one piece of software from this list, this is the one you should go for.

AIDA64 Extreme Edition
www.aida64.com/products/aida64-extreme
We're not clear on what it is that makes this version of AIDA64 'Extreme' (though the only alternatives are expensive 'engineer' and 'business' versions) but, that aside, it's hard to criticise this all-purpose benchmarking software. Designed as a streamlined Windows diagnostic and benchmarking tool, AIDA64 Extreme Edition can assist with overclocking, hardware error diagnosis, stress testing and sensor monitoring. It simultaneously keeps track of the condition of your CPU, memory, and disk drives, and is compatible with all versions of Windows.

The analysis tools are sufficiently thorough for domestic or enthusiast use. It allows for a number of CPU processing benchmarks, tests on RAM bandwidth and latency, and the transfer speeds of any attached disk – whether it be a mechanical drive, a solid state drive (internal or USB-based) or an optical drive.

Stress tests for each type of hardware give your components a proper going over, and there's even one for the GPU as well, which will please the faction of

PassMark PerformanceTest 8.0

AIDA64 Extreme Edition

Unigine Heaven Benchmark 4.0
unigine.com/products/heaven/

If you want a 3D benchmarking suite that'll test your graphics card to the limit, but won't demand similar from your wallet, Unigine Heaven 4.0 is the one to go for. Designed as a stress-tester, first-and-foremost, for testing the stability of a GPU, it's also an excellent choice for overclockers who want to check that they've provided adequate cooling performance and need to guarantee stability when playing games. If your hardware can survive Heaven's benchmarks, it can survive anything!

The tests are non-synthetic, and similar to 3DMark in that they involve interactive navigation of a genuine, fully rendered 3D world designed for the purpose of testing cards to their fullest extent. The benchmarking takes place entirely in the GPU, so there's no chance of the processor or memory influencing the results, and tests can be tweaked to place the emphasis on individual graphical features. It also supports multi-monitor setups and stereographic 3D. There's also a software-only rendering mode that can be used as a reference.

It's definitely one for enthusiasts, but beginners may still get something from it as long as they've got a glossary on hand to look up any terms they don't understand. As graphics benchmarking software goes, it suffers from placing such a heavy focus on gaming when there are other things people might use a graphics card for. It's definitely the best example of a graphics testing suite around, however.

In fact, we'd recommend Heaven even if it wasn't free. The fact that it is just makes it all the more attractive over its rivals. There are two more advanced commercial versions available – a $14.95 advanced edition (which you might want to try) and a $495 pro version (which, er, you probably won't). **mm**
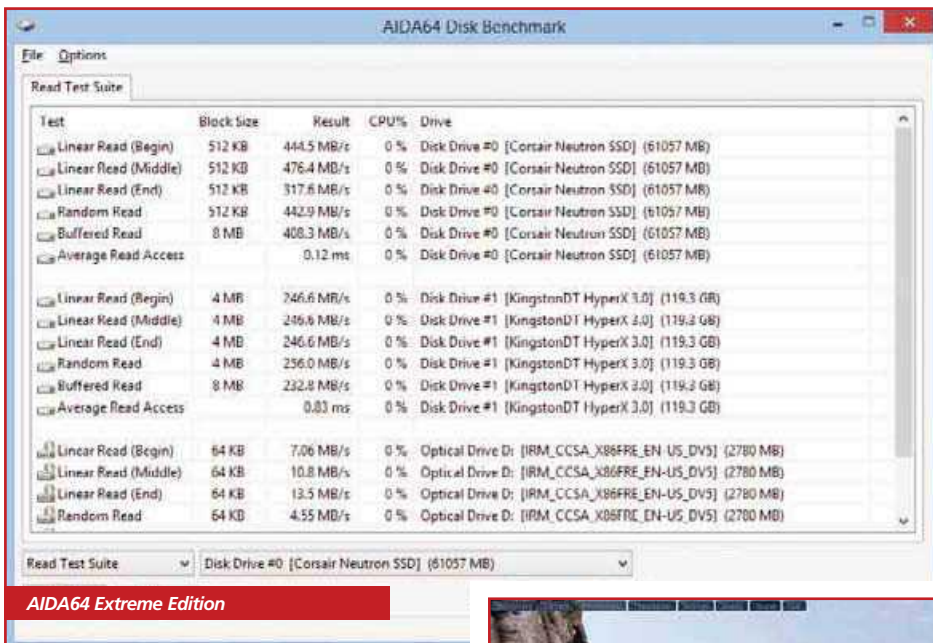
gamers constantly looking to tweak their system to optimum performance. Also, if you've got the necessary sensors in your system, AIDA64 will monitor temperature, voltages, power drain and fan speeds, and this information can be displayed in a number of areas, from the system tray to a makeshift OSD.

The software sets itself up well as a one stop shop for benchmarking. It's clear interface and wide range of tools give you everything you need to get started with benchmarking. Ironically, as it's ideal for beginners, the price ($40) could arguably be a little high for newbies.

Unigine Heaven Benchmark 4.0

MAKE
WINDOWS
10
FASTER

**A lean OS makes for a faster PC,
so here's how to get Windows in shape**

A slow Windows installation is always a difficult thing to deal with, and now that Windows 10 has had some time to bed in after release you might find that it's really starting to crawl. Whether you want to get the fastest performance out of your PC or recover some lost ground you need a Windows to play ball, so here we've compiled are a few hints and tips to make sure it does.

While this advice is mostly written with Windows 10 in mind, these steps should also work for Windows 7 and 8 too, though the exact wording and location of options will differ.

1 Go Straight To Shutdown

Windows 10 doesn't like being actually shut down, that much is certain, but many of us still like to power down our computers when we're not using them. This takes several precise clicks on Windows 10 – but there is a way you can fettle it to get there faster.

You can cut the time down by making a new shortcut (right click on your desktop and select New > Shortcut) and then enter the following command:

%windir%\System32\shutdown.exe /s /t 0

This will shut down the local computer with a timeout of 0 seconds. If you add /f to the switches, it'll force-close your applications too, so you don't even have to shut those down – but remember this could lose your work! The shortcut can then be left on the desktop or put on your start menu/taskbar for easy access.

2 Disable Thumbnails

If you have a directory full of pictures or videos, trying to browse the folder can become a little bit like trying to swim in a pool of tar. Whenever you browse it, Windows tries to load new thumbnails from scratch resulting in a slow, churning disk drive and a long wait as it tries to do something that probably takes several times longer than whatever task you were planning on.

Disabling the thumbnail preview feature entirely will stop Windows from creating previews of these files when you enter the directory, leaving you to browse them at your own pace. To do this, open Windows Explorer, click View > Options > Folder and Search Options > View, then tick the box that reads 'Always show icons, never thumbnails.'

This option is mainly useful for mechanical drives rather than SSDs

(which should be quick enough to load thumbnails near-seamlessly), but if you browse a lot of media and don't need thumbnails, it could save you hours in the long-term!

3 Disable Defender

Windows comes with its own anti-malware program installed, but the reality is that it's light on features and protection that most people would consider essential. It's better than having no dedicated antivirus, but it's not as good as having almost any commercial version either.

Assuming you've already got a good virus scanner installed, there's absolutely no reason to leave Windows Defender enabled too. It'll routinely download updates, slowing down your Internet connection and using up processor and memory resources that might be better spent on an actually useful antivirus program.

To disable Windows Defender, open the Update & Security section of the control panel, click on Windows Defender, and disable both real-time and cloud-based protection. You may find that Windows thinks you have created a security risk by doing this, but you can turn those warnings off if you're confident in your antivirus – indeed, most will be recognised by Windows automatically.

4 Load Less On Boot

We've all had PCs that go sluggish after being switched on, preventing us from getting to work as it grinds away at some unexplained task. The problem is usually that Windows tries to load a huge amount of background services as soon as you log in, many of which you don't ever need – let alone every time you run it.

To disable some of these, hit ctrl-alt-delete to bring up the task manager, click 'more details', find the 'start-up' tab and then see which, if any of the programs listed you can get away with removing. Many of them will be required, but some of them will be helper apps you can't imagine using. Just don't disable anything you don't recognise and you should be okay.

Usefully, this section will also give you a notification of how long your last boot took ('Last BIOS time') so when you've made your changes you can reboot your PC and see what, if any material difference it had.

> **" Windows 10 doesn't like being actually shut down, that much is certain, but many of us still like to power down our computers "**

Disable Windows Defender

5 Stop Flashy UI Effects

You'd be surprised how much effort your system can expend on a flashy interface, especially if you don't have a separate GPU capable of doing the heavy lifting. As much as we all love the various effects of Windows' interface, it's hard to deny that the resources spent on these frivolities might be better spent on running your software.

To disable these nice-but-not-necessary effects and recover valuable CPU cycles, right click on your desktop and select 'Personalise'. Scroll down the 'themes' box and choose 'Windows Basic' or 'Windows Classic'. The new theme you've chosen, without the effects, will now be enabled. Your system resources are then free to concentrate on more pressing matters.

In Windows 7, 8, and 10 you also have the option to disable other animations and eye candy that suck up resources better expended on essential tasks. That's not always a huge amount, admittedly, but enough to make a difference on low-end systems. To disable them on an individual or collective basis, press Windows+R, type 'SystemPropertiesAdvanced', click 'Settings' under the performance heading and select 'adjust for best performance'. If there are some effects you can't live without, you can also turn them on and off individually using the 'custom' settings below.

6 Kill Program Components

There are plenty of parts of Windows that, for whatever reason, you may never use and which simply hang around your installation taking up space and being loaded every time you boot – to zero positive effect. Any such disused services and applets can be easily discarded in favour of recovering the hard drive space, RAM capacity and the CPU time they occupy.

To find and disable any such excess baggage, click Start, type 'Control Panel', then select 'Programs and Features'. In the pane on the left, click 'Turn Windows features on or off'. You can now go down the list and uncheck any features you see that you don't use, freeing up resources and generally decluttering your installation.

7 Axe Search Indexing

The Windows Search Indexer can spend ages reading file contents and storing them so that your searches run that little bit faster. However, if you don't run searches very often, or even use another program, the Indexer is just wasting time churning up your hard drive for no good reason. Disable it by clicking 'Start' and typing 'view local services' into the search box. Press enter to bring up the 'Services' dialogue, then in the list of services, find 'Windows Search'. Right-click on it and open the 'Properties' dialogue. Choose 'Disabled' in the 'Startup type' drop-down, then click OK.

Next time you reboot, the indexing service will be disabled, giving you back the resources it would otherwise be taking up. Note that you may get a warning that it is disabled whenever you perform a search in the future. To remove this warning, open Windows Explorer, click View > Options > Folder and Search Options, navigate to the Search tab, then check 'Always Search File name and contents' and 'Don't use the index when searching.'

Remember, disabling the indexer will have the consequence of slowing down any searches you perform – particularly if you're searching for the contents of files – but if you only do the very occasional file search it's probably better to let the delay happen when you want to perform the search, rather than constantly when you don't want to.

8 Remove Unwanted Fonts

When certain applications (such as Word or Photoshop, for example) launch, they can spend a significant amount of time reading in all of the different fonts on your system. Removing fonts that you do not use, therefore, can speed up the launch times and free up resources while those programs are in use.

To uninstall them, open Control Panel > Appearance and Personalisation > Fonts, then select the font/s you want to get rid of and simply hit 'Delete'.

Disable Unused Program Components

Remove Unwanted Fonts
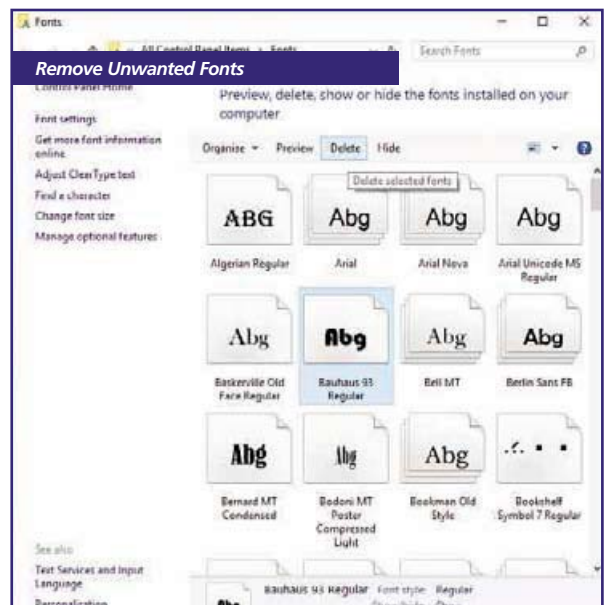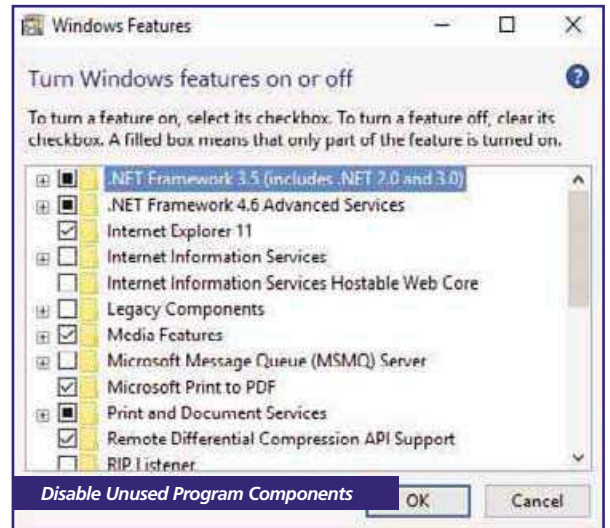
9 Unplug Unused USB Kit

It may not be obvious, but when you have USB devices plugged in (and switched on, if they don't get their power from the USB socket) then Windows will notice. What's more, when it does, it'll helpfully load the drivers for them, assuming you won't mind the slowdown that occurs in your start-up process while it does.

However, if you've got a microphone, game controller or some other peripheral that only gets used once every ten times you

> 66 **You'd be surprised how much effort your system expends on a flashy interface, especially if you don't have a separate GPU** 99

boot your PC, unplugging it will prevent Windows from loading the necessary drivers, shortening the time it takes from you logging on to you being able to actually use your PC in any meaningful way. A simple but surprisingly effective trick.

10 Manage Your Apps
If there's one program that seems to be suffering because of another – maybe video playback that's stuttering, or games that keep slowing down because your antivirus wants to pile on some more resources for a background scan, there is a way you can tell Windows to prioritise one program over another.

All you have to do is open the task manager (CTRL+SHIFT+ESC), open the 'processes' tab, then locate the program you want to prioritise. Right-click the name of it and in the context menu choose 'Set Priority' and choose the value you want.

You can deprioritise as well as prioritise applications, but generally you only have to set the one you want to a high level – they're relative values rather than absolute ones, so setting one program to high priority will have the same effect as if you set all of the others to low priority.

It's important not to interfere with processes you haven't launched yourself, though. Changing their priority could cause your system to lock up or crash. Avoid setting processes to 'real time' priority as well. This will devote your system's maximum possible resources to the task, which is fine as long as it's not stuck in a loop or otherwise non-terminating. Again, click the wrong thing and you may end up with a locked system that needs a reboot to get working again.

11 Kill Sound Notifications
The dings and chimes of Windows and its many alerts can quickly become familiar. However, in sounds like some kind of bizarre holdover from the days of Windows 95, turning on sound alerts can actually cause Windows to delay refreshing itself in various ways. It may only mean the very briefest of pauses while it caches a wav file,

but it's noticeable in a small way – again, particularly if you're working with low-end hardware.

Disabling sound notifications on alerts has virtually no effect on Windows' operation, assuming you have no visual impairments and don't directly benefit from them, but it does contribute a tiny speed increase. To get rid of them, open the 'Sound' section of control panel, find the sounds tab and set the scheme to 'no sounds'. This will get rid of all audio related to dialogue boxes and pop-ups, and recover those lost milliseconds which, in an OS as notification-prone as Windows, can really stack up.

12 Organise Your Apps
If there are certain programs you use daily – stuff like your browser, notepad, and Windows Explorer – then it pays to keep them only a click away. The Windows start screen and start menu might be relatively quick, but the programs they feature are all a couple of actions away at best, whether that's key presses or clicks. By contrast, if you pin your most-used apps to the taskbar, you can launch them in a single click or the push of a single shortcut combination. Repeated hundreds of times, that's a genuine time-saver.

The easiest way to pin an application to your taskbar is to wait until it's running, right-click on the taskbar icon, then select the 'pin this icon to the taskbar' option – though you could also drag and drop it from the desktop or an explorer window, or right-click a shortcut and select 'pin to taskbar' – in fact, Windows offers so many ways to do it that there's no real excuse not to.

Disable Sound Notifications

13 Monitor Performance
Windows 10 features a useful tool known as the Performance Monitor. To use it, press Windows+R to bring up the run dialogue, then type 'Perfmon /report' and press enter. The Resource and Performance Monitor tool will launch and proceed to gather data about your system for '60 seconds' (it actually takes a lot longer – several minutes at least) before displaying a list of events and processes that were active during that time.

While you can view this report and interpret it as you like, the best thing to do is go straight to the 'warnings' section, which will show you any major problems that need to be fixed. The resource overview section will also tell you (with colour coding) which components of your PC are strained, giving you the opportunity to do something about it whether that's to install an upgrade or tidy your system up. **mm**

Use Performance Monitor

THE
COMPLETE
WATER
COOLING
GUIDE

In association with Falcon Computers

Keep the temperature down with our handy tips…

If you're the kind of system tinkerer who reads a magazine like Micro Mart, it's a safe bet that you're probably aware of one of the basic principles of computing: if you want your components to perform at their best, you have to keep them as cool as possible. When components get hot, they become unstable. When they're kept cold, they become more efficient and less prone to failure. That's why processors have fans and why hot days are bad news for server rooms.

Especially in summer (admittedly, perhaps not *this* summer), it's always worth making your system's cooling more effective. What if you want to overclock your chip without dramatically shortening its lifespan? What if you've got a system that generates heat as quickly as fans can blow it away? What if you want to find a way to keep your system stable even during the worst heatwaves?

Well, the answer to all these questions may well be water cooling. Formerly the preserve of only the most dedicated enthusiasts, water cooling has spent the last few years becoming more affordable and easier for even novices to deal with. The days of custom cooling rigs being the only option are long gone.

Admittedly, it's still not the easiest procedure in the world, but closed-loop, pre-assembled liquid coolers mean it's now almost as simple to install water-based cooling systems as it is to install a fan and
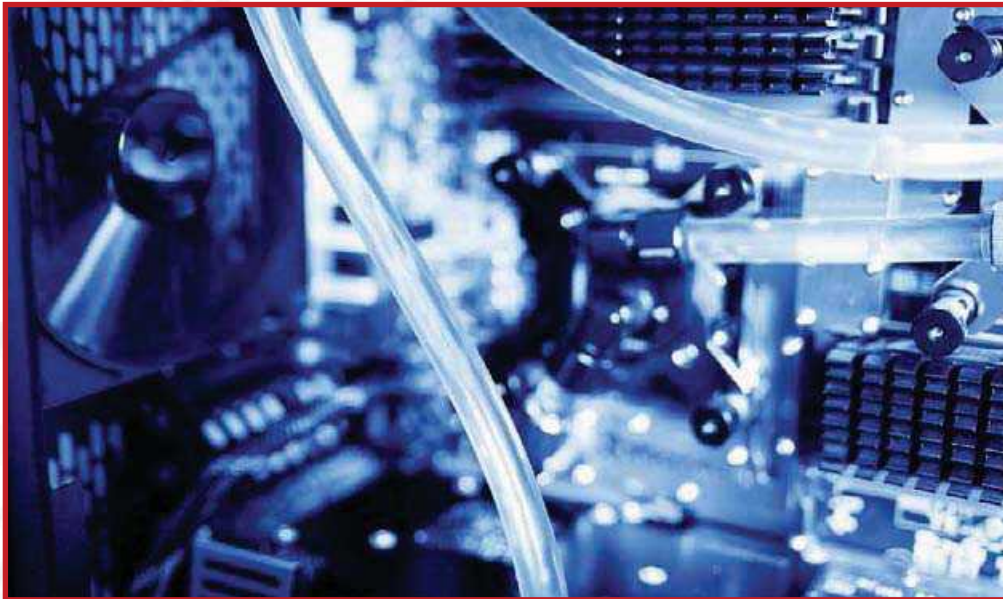
> 66 **It's now almost as simple to install water-based cooling systems as it is to install a fan and heatsink, and hardly any riskier** 99

heatsink, and hardly any riskier. But how do you know if you need water cooling or not? And how do you get started installing it? Hopefully, we can answer these questions with our complete water cooling guide.

How Does Water Cooling Work?

Normally, computer fans cool your components by allowing heat to dissipate into the air, and then blowing the warm air away so it can be replaced by new, cooler air, which can absorb more heat. But this is an inefficient process. Air accepts heat quite fast, but not as fast as many other materials – after all, it's not very dense. This is why heatsinks exist: because metal transfers heat away from the component faster than air can, and can dissipate it into a larger volume of air.

In comparison to air, water has both a higher thermal conductivity (so heat is transferred faster) and a higher specific heat capacity, meaning that if you have the same volume of water and air, the water can hold more heat before it starts to feel hot.

Water cooling systems use liquid tubes to run fluid across components, which absorb the heat within them. The water then passes through a

radiator, which acts like a heatsink, transferring heat out of the water and cooling it back down again, a lot like a car radiator.

You can make bespoke water cooling systems or buy them off the shelf, but regardless of which route you take, you'll always find that they're made up of the same components: a pump to move the coolant, a tube ('loop') to contain the coolant, the coolant itself and a radiator that can dissipate the heat. Radiators may be heatsinks, but it's more common for them to contain a fan.

Although some cooling systems require you to attach the pipes directly to the component with thermal compound, it's also common to find water blocks that are heat-conductive pieces of metal, which contain hollow tubes where water can flow. Where heatsinks dissipate water into the air surrounding them, water blocks dissipate the heat into the water that flows through them.

Water cooling units can be applied to any heat-generating component, but they're most commonly applied to CPUs or GPUs, though you can water cool any components that get hot. It'll all benefit from being kept cool; the only question is what sort of expense

you're willing to go to in order to make that happen.

It's worth pointing out that water cooling is mostly useful for high-temperature systems where components are being continually stressed, whether that's because you've overclocked them or because you run them at high-capacity for a long time (gaming and video encoding are two tasks where water cooling would definitely benefit the hardware). If you run a low-temperature system, air cooling is probably more than enough to keep the temperature at safe levels – though water cooling can still provide a quieter method of removing heat from components.

What Water Cooling Hardware Exists?

We touched on this briefly, but water cooling systems come in two forms: homebrew or bespoke self-builds, where the entire loop is constructed out of individually purchased components or off-the-shelf prebuilds, where you buy the entire system and simply install it as you would any other cooler.

Prebuilds are sometimes referred to as 'closed loop' systems, because they don't require the user to manually add coolant. It starts with the amount it needs, and because the loop is closed, it shouldn't ever need replenishing.

Buying a prebuild has its advantages, especially for beginners. It's safer, because it's been professionally constructed. It's simpler, because you don't have to check compatibility between multiple components or learn about coolant levels yourself. And it's easier to get hold of, because even high-street computer shops sell water coolers.

But bespoke systems have their advantages too. You can tailor them to your personal needs, and they're cheaper to construct. It's also easier to apply water cooling to non-standard components. Off-the-shelf systems are largely aimed at CPU cooling, with the possibility of GPU compatibility. Bespoke water cooling can essentially go anywhere you like.

If you want to build a bespoke system, here's what to look for:

1. A waterblock. Make sure you buy one that is compatible with the

hardware you want to cool. CPU waterblocks tend to be universal, but those for GPUs, RAM and other components require you to look carefully at whether the block fits your specific model of hardware

2. A radiator with fans. Sold as a single unit, radiators come in multiple sizes and contain differing numbers of fans. More fans means they can dissipate more heat, but it also makes them louder. Two 120mm fans is standard, but you can get radiators accommodating a single fan or up to four. They're usually mounted internally but can also be mounted externally in smaller cases.

3. A reservoir. These allow you to add liquid into the loop and help you bleed out air bubbles that reduce the efficiency of the cooler. Most of them are mounted inside your case using brackets that are provided, but some can also fit inside existing drive bays.

4. A pump. This keeps the water in your cooler moving. Sometimes pumps will come integrated into a reservoir, but it's also possible to buy them separately. If you do buy them separately, make sure the two use a compatible interface.

5. Fittings. Fitting allow you to connect tubing to components, so you'll need some for every separate component: the pump, the radiator, the waterblock and the separate reservoir if you have one. They come in several

Further Resources

The topic of water-cooling is far too big for us to cover every aspect of in a single guide, but if you want to research more products, techniques and guides so you can get started, here are some sites where you can do just that.

www.watercoolinguk.co.uk: A UK-based specialist store and water cooling resource, selling everything from individual cooling components to all-in-one loops. If you can't find what you want here, it probably doesn't exist.

www.reddit.com/r/watercooling: Reddit's Watercooling subreddit, which is a great place to get advice and help with builds, particularly custom loops. As with all communities, it's a good idea to lurk first rather than blunder in, but you should be able to get very specific help here.

bit.ly/1k1JTMY: Lifehacker's video guide to water cooling. If you need a step-by-step guide and you missed our recent one, this Lifehacker video gives you an example of how to install a water cooling system from scratch. It may be a little out of date, but it's still one of the better examples.

different forms. Barb fittings are cheap but effective, while compression fittings are more expensive but look better and are extra-secure. Fittings allow you to connect

6. Tubing. Once you've chosen the fittings, you also need to find tubing with the same diameter. You can use smaller tubing for a tighter fit, but this also increases the risk of tearing, so we don't recommend it.

In addition to this equipment, you also need coolant. Despite the name, it isn't just water. Rather, they contain a water-based solution of chemicals, with additives designed to improve heat conduction, and to prevent

limescale build-up, corrosion and other adverse reactions.

A biocide, for example, prevents any algae or mould from growing inside the equipment, though an alternative might be a 'kill coil', which is a small piece of silver with naturally antibacterial properties. Anti-corrosives are necessary if you have more than one type of metal in your loop (for instance, a copper waterblock and an aluminium radiator), to prevent the metal being eroded or oxidising, which reduces efficiency and may clog the system. Some people also want to add a drop of washing-up liquid, which helps prevent air bubbles forming.

Some enthusiasts also like to put colouring into their mix, but we'd advise against this. Household colourants can affect performance and, depending on the substances involved, may bind with other additives to create lumps inside equipment that could clog it up entirely. If you want a coloured effect, we'd recommend using transparent coloured tubing.

Do I Need A Water Cooler?

Water cooling is aimed at high-end users who are used to customising a system and will probably be acutely aware of the cooling requirements before it's even built. The only circumstance in which you might need a water cooler and not be aware is if your CPU frequently gets too hot and crashes, but you'd know if that was the case.

But just because you don't need one, that doesn't mean that you can't want one. Virtually every system will benefit from water cooling in some small way. Here are a few situations where we think water cooling is seriously worth pursuing,

If you're running (or plan to run) an HTPC, then the system can hugely benefit from the reduced noise a water cooling system offers. They aren't zero-noise coolers, because you still have to run the exhaust fan, but they run at a more consistently low volume and are less likely to speed up during an important part of a film or TV show and kill the mood.

Additionally, water coolers tend to be more compact than standard CPU fans, because the CPU heatsink and fan aren't locked together in a single giant lump. If you've got an HTPC in a mini or non-standard case, the flexibility of a water cooler might be more convenient than a standard, immobile cooler.

In the gaming world, SLI/CrossFire systems will also benefit from the use of a water cooler that can reduce the temperature of graphics cards that have been placed close together, where air might be difficult to properly extract. A water cooler's ability to snake around the cards means the lack of space won't cause a problem.

Some people also cite the looks of a water cooler as being integral to their appeal. Certainly, they have a
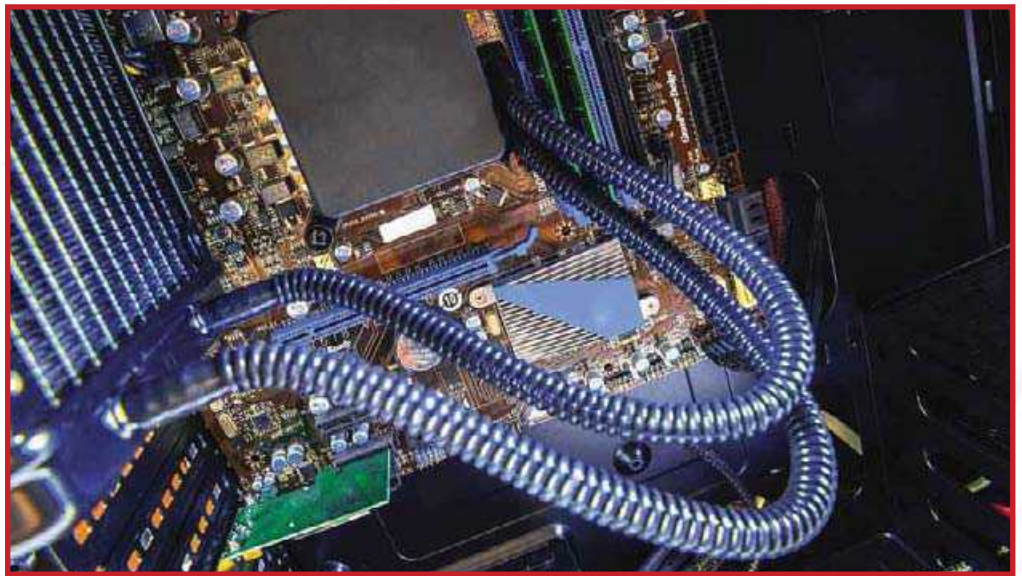
> ❝ **Just because water cooling has a lot going for it, that doesn't mean you should use it exclusively** ❞

neo-industrial charm, especially the ones that come with built-in lighting or different coloured coolants, but this is purely a matter of taste!

Perhaps the best reason to use a water cooler, however, is if you're planning to overclock your components. If you want to push your CPU or GPU further than their stated limits, you need to make sure they stay as cool as possible. OEM fans – the ones they come bundled with – are very basic and don't have much built-in tolerance for extra heat. If you're overclocking, a new cooler is a must-buy, and a water cooler is the best of those available.

When Are Fans Better?

Just because water cooling has a lot going for it, that doesn't mean you should use it exclusively. There are plenty of situations where a standard fan might be a better choice.

Primarily, a standard CPU fan costs a lot less money than a water cooler. If you're building a system on a budget, it can be hard to justify spending the extra money a water cooling unit demands. As well as costing less in absolute terms, they're often worse value than a fan if you look purely at the amount they cool versus their cost.

That said, they can still save you money – a water cooler and overclocked processor will cost less than the equivalent speed processor – but if you're running a budget system containing a low-end CPU, it's likely a half-decent fan cooler would be able to do just as well with the hardware.

Water coolers are also likely to be unnecessary if you're not running a high-end gaming system. As we've noted, some HTPCs might benefit from a water cooler, and all PCs see some benefit, but if you're a casual gamer or light desktop user, there's no sense in using a water cooler. It would be like buying a Ferrari and using it to drive to the shops and back once a week.

Fans are also better if you're just not that technically minded. Sure, water coolers aren't that difficult to fit, but they are quite definitely more complicated pieces of machinery than the average CPU fan – if only because there's one only thing to plug in on a CPU fan!

Hopefully that answers the most pertinent questions about what water cooling is, how to get started and what you can do with it. All that's left for you to do is to get out there and give it a go! **mm**

WHY DOES OVERCLOCKING WORK?

James Hunt uncovers some of the secrets of this fascinating activity

Whether you've just bought new hardware or want to squeeze some extra life out of an existing system, overclocking might be an option worth considering. By pushing your computer's hardware faster than its intended speeds, overclocking gives you the opportunity to save money in the short term at the expense of your system's eventual lifespan – and let's face it, most of us don't use our computers until they wear out.

But what is overclocking, and why does it work?

Basics Of Overclocking

The term 'overclocking' originally referred to one specific thing: raising the clock speed of your PC's CPU so it performed instructions more quickly and therefore performs better at CPU-intensive tasks. These days, RAM and GPUs can also be overclocked, but the principle remains the same: pushing the hardware faster than the manufacturer recommends.

The reason overclocking works on a technical level is that hardware doesn't have a hard limit to what it can cope with. The way CPUs are designed means that if the chips are the same generation, then the slowest Core i5 is architecturally identical to the fastest Core i5. The difference is in the quality of the manufacturing and materials.

Essentially, the hardware isn't made to be a specific speed – it's made and then tested to find out what speed it runs at, and then sold at that price. The point chosen for each batch is the one that the greatest number of chips will function optimally at, but individual chips might be better. Indeed, sometimes faster chips are purposefully rated lower to meet a certain quota or demand. Sometimes the only difference between a fast and slow chip is that the CPU has been hardwired not to use certain capabilities, meaning it could be running a lot faster if given the chance.

If you're reading that and thinking 'Great, I'll overclock my chip right now and unlock its hidden capabilities!' then it's worth waiting a moment. The important point to note is that chips are rated within a certain tolerance. If you buy a 2GHz chip manufactured under a 10% tolerance, you might have taken home a 1.8GHz chip that's already overclocked or a 2.2 GHz chip that's deliberately underclocked. There's no way of knowing for sure.

If you just use your chip normally, then no problem; you'll never notice. That's exactly what the tolerance is there for. The problem comes when you decide to try out overclocking, because if you think your 2GHz chip can be overclocked by 15%, you might decide to set it to 2.3GHz straight away. If you picked up a 2.2GHz-rated chip, then you're barely taxing it. But if you picked up a 1.8GHz chip, it's suddenly overclocked by around 30%, and disaster will surely follow.

What Are The Risks?

When we say disaster, we mean that the hardware itself will fail, potentially taking other components and data with it. Processors of all kinds, get very hot even under normal use, and if the hardware isn't sufficiently cooled (i.e. by your CPU fan), it'll literally melt inside. Overclocking gambles the extra speed you can obtain by pushing hardware faster against the potential that the hardware can't survive that increased speed.

The cause of overclocking damage is rooted in the chemical
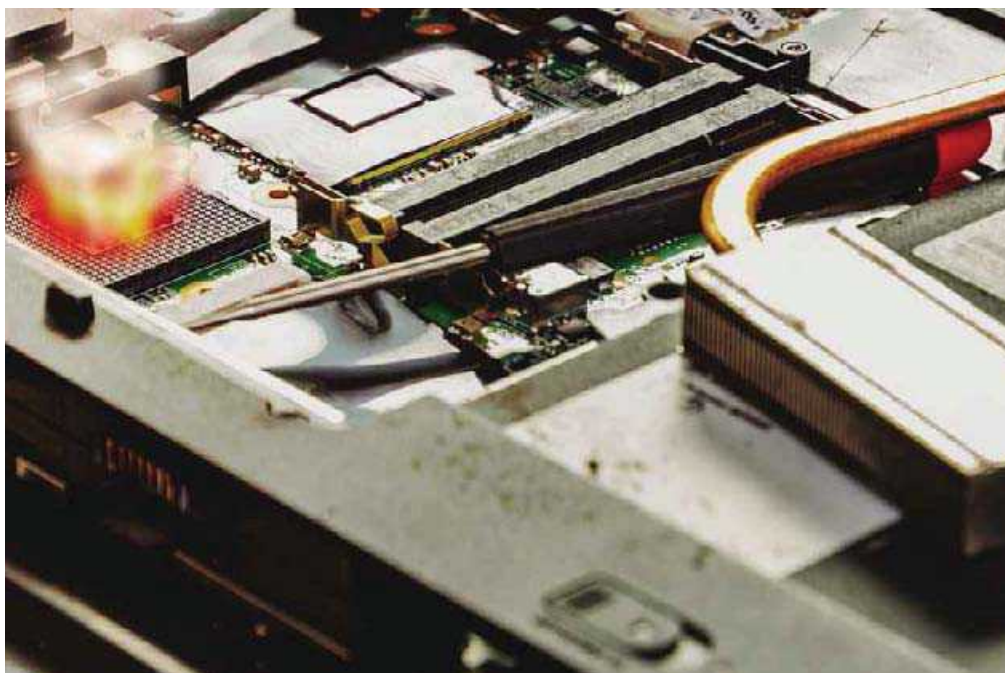
> **❝ It is possible to overclock safely in a way that minimises the risks and maximises the rewards ❞**

makeup of your components. CPUs, GPUs and RAM chips are made out of millions of transistors, which are themselves mostly constructed from semiconductive silicon. The reason silicon is used is because its electrical resistance decreases when the temperature rises, which is the opposite of what happens in more common metals.

This means that if silicon gets hot enough, it becomes fully conductive, which results in an electrical short that can damage your hardware permanently. That's why you have to keep it cool. Ideally, you want your processor (CPU or GPU) to be kept in the region of 70-80°C, but that's only a rule of thumb. Some chips will have much higher tolerances, some a little lower, and you should be able to find a fairly reliable range for your hardware if you see how other overclockers got on with it.

If the hardware does overclock reasonably, the extra heat generated will inevitably shorten the processor's operational lifespan. If pushed beyond its rated tolerances, it could fail almost instantly. Equally, it might shave

a year off a ten-year lifespan. There's no way for a consumer to be sure, so as soon as you start overclocking, it becomes a gamble. A speed increase now in return for a shorter time with your hardware.

Even if the hardware doesn't fail instantly, overclocking makes the hardware less stable over time. Since heat is the problem, you might find your computer starts crashing if the fan becomes gets dusty and inefficient, or even if it's just a hot day. An overclocked piece of hardware is always more vulnerable to stresses than an average, factory-setting one.

For this reason, there's another, less direct hazard: you void your warranty. This kind of tinkering is considered outside normal use, and therefore if you indulge it and your hardware fails, you can't get anyone else to pay for your mistakes.

Safely Overclocking
Despite all that, it is possible to overclock safely in a way that minimises the risks and maximises the rewards.

In practical terms, overclocking involves raising voltage and

multipliers, and the more you do that, the greater the likelihood of failure becomes. To mitigate the risks, start by making small increments in the multiplier and only step up the voltage when the chip becomes unstable because it's not getting enough power (you can tell when this happens, because the chip will be unstable at lower temperatures). Remember that even if someone else claims to have pushed the same model of chip to 4GHz, you shouldn't start there. Every individual chip has different tolerances,, and if you go in too high, the damage might be instant.

A good way to check your system before (and after) you overclock is to run a stress test, which will tell you whether it's running correctly under its current settings. To do this, all you have to do is run a benchmarking tool with your CPU's default configuration so you have a baseline with which to compare future changes. If the hardware doesn't crash, you know you're safe to at least try overclocking. If it does, you know you're due a replacement!

The other thing that can negatively affect overclocked systems is, perhaps a little surprisingly, the PSU. If your power supply unit is cheap, old or otherwise inefficient, it might be providing a 'dirty' stream of electricity. A dirty supply gives an uneven voltage, which can spike and drop, leading to instability (or even damage!) in systems where the tolerance is tight – overclocked systems, for example. There's no particularly easy way to test this without specialist equipment, but if you notice otherwise unexplained problems, your PSU might be the source of it. If you're building a new system, try to buy a high-capacity, 80 Plus-rated PSU to ensure a clean supply of electricity.

Hopefully, that's given you some idea of what the background of overclocking is. If you're planning to do it, remember that this isn't an exhaustive guide to the procedure, just a general overview. It almost goes without saying that if you choose to overclock, then it's with full knowledge that your system can be permanently damaged as a result. Try it at your own risk! **mm**

SUBSCRIBE NOW!

Subscribe to **micro mart** today and save on the single issue price.

Each issue of *Micro Mart* will be delivered directly to your device each week.

HOW TO SUBSCRIBE...

...on an iPad or iPhone

STEP 1   Return to the *Micro Mart* library

STEP 2   Choose your subscription term and tap twice on the 'price' box

STEP 3   Choose whether to create an optional PixelMags account

STEP 4   Enter your Apple ID password to confirm

...on a Kindle Fire

Kindle Fire subscriptions come with a FREE one month trial.

STEP 1   Tap 'Free Trial Subscription' in the *Micro Mart* library

STEP 2   Chose your subscription term from the drop down menu on the popup that appears

STEP 3   Tap 'Subscribe'

available on
kindle fire

...via the Zinio app

STEP 1   Search for *Micro Mart* via the search box in the Shop tab

STEP 2   Tap the 'Subscribe' button

STEP 3   Choose whether to create an optional Zinio account

STEP 4   Enter your Apple ID password to confirm

Subscribe to *Micro Mart* today and save on the single issue price
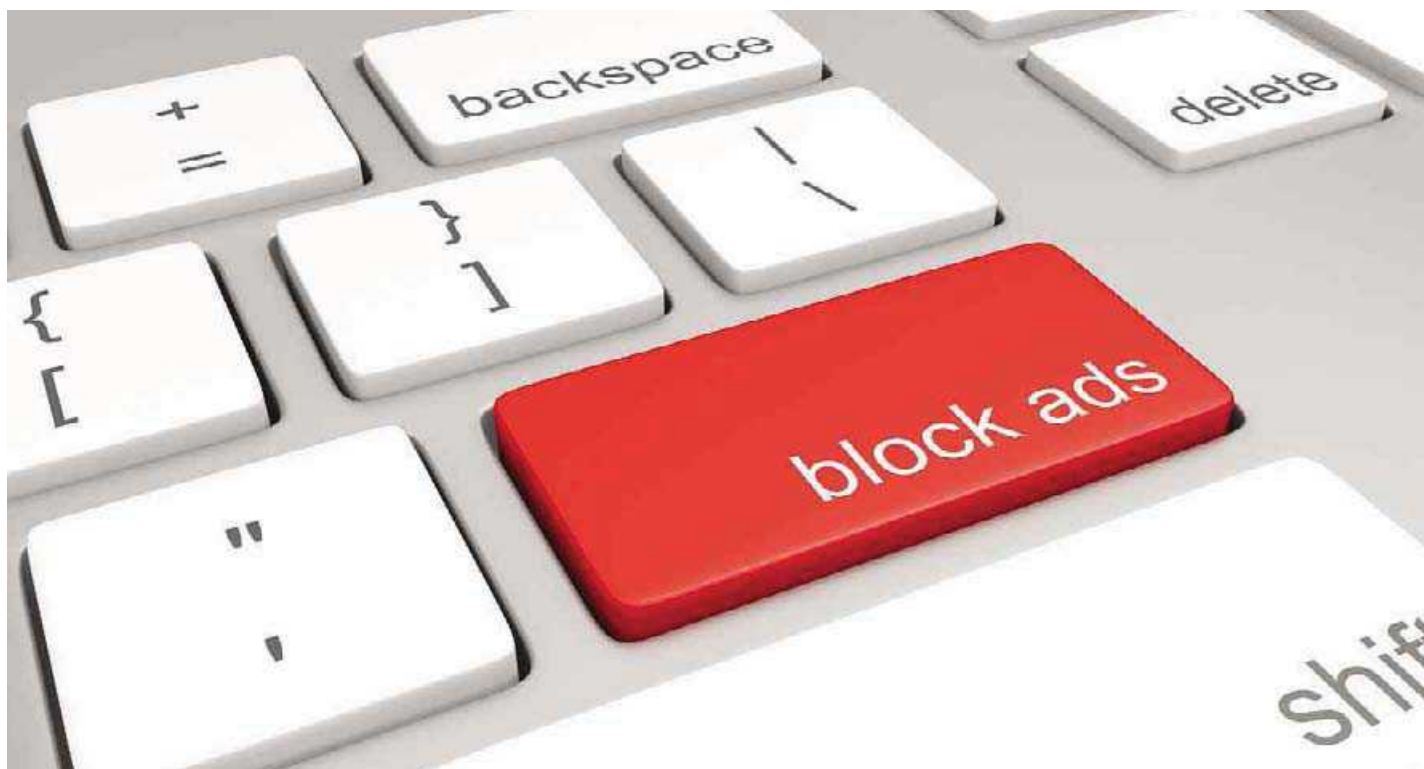
How To Stop Pop-ups

Adverts can be a pain, so here are some tips on how to get rid of them

Advertising has to exist; this is a fact of life. It pays the bills, and it's what keeps many of your favourite publications and sites still going after all these years. But among the reasonable forms of advertising lies the pop-up, suddenly springing up in front of you when you're reading a page or viewing a video.

Often it'll be trying to persuade you to buy the latest phone or holiday or something else equally materialistic but otherwise harmless. Other times, and mostly depending where on the internet you spend your time, you'll see adverts for pharmaceutical enhancements for certain parts of your anatomy, or for the talents of men or women who are skilled in various 'arts'.

There are also more menacing pop-ups that attempt to get you to click on them so they can download some virus or tracking nasty. Or they're developed to con you in some way or another.

In short, a lot of pop-ups are a menace, and we could really do without them. So how do you go about stopping and blocking them for good?

Firefox

Most modern browsers do a pretty good job of automatically making sure that the nastier pop-ups are blocked from ever appearing. But on occasion, the settings that stop pop-ups can get reversed, due to an update or simply through an accidental click at the wrong time.

If Firefox is your main web browser and you want to double-check the pop-up settings are working, click on the menu button, represented by three horizontal bars in the upper-right corner of Firefox.

With the menu open, click on the options button – the cog icon – and once the options tab has loaded, click on 'Content' from the left-hand menu pane.

Within the content window, make sure that the 'Block pop-up windows' option is ticked, and click on the 'Exceptions' button to the right of it – which will launch its own window – to make sure a site hasn't auto-inserted itself. If there's an entry in the exceptions list that you're not familiar with, click to highlight it, then click 'Remove Site'. Save any changes and exit from the options tab.

While the built-in pop-up blocking technology in Firefox is good, you can boost it by installing one of the many freely available Firefox add-ons. With regards to stopping pop-ups, you won't go far wrong with the excellent Adblock Plus add-on (**goo.gl/EWwBkt**).

Adblock Plus will block all unwanted pop-ups and adverts from appearing in the browser while you're online, but improves its function by allowing acceptable adverts through that are an accredited source of income for the site you're visiting.

To enable it in Firefox, from the main page click on the green 'Add to Firefox' button followed by 'Install' in the Firefox download window that appears. Adblock Plus doesn't require a restart of the browser, but you can quickly close it down and reopen it for the base setting to take effect.

⌃ *Pop-ups, the scourge of the modern internet*

Chrome

Chrome is one of the better browsers when it comes to built-in pop-up stopping technology, which is part of why it's such a popular browser.

As with Firefox, though, sometimes the settings can get altered for one reason or another. So to make sure that they're operating in your best interests, start by clicking on the menu button that, like Firefox, is represented with three horizontal bars in the upper right of the Chrome window.

With the Chrome menu up, click on the 'Settings' option in the list and scroll down to the bottom of the page and click on the blue link 'Show advanced settings…'. This will extend the available options, so scroll down some more until you reach the privacy section and click on the 'Content Settings' button.

This will launch a separate window, which you'll need to scroll down to reach the pop-ups section. Make sure the 'Do not allow any site to show pop-ups' option is selected and, as before, click on the 'Manage exceptions' button below to make sure that no sites have added themselves to the list.

If all is well, you can click the Done button to close the Content Settings window and Done again to return to the Chrome Settings tab.

If you want to extend Chrome's pop-up stopping capabilities, then as before you can install a dedicated third-party pop-up blocker. In Chrome, these are called extensions, and you can access them by clicking on the extensions option located on the left-hand side of the Chrome settings tab – which you should still be in after clicking on the 'Done' button previously.

With the extensions tab now open, scroll down to the bottom of the page and click on the 'Get more extensions' link; this will launch the Chrome Web Store. Search for and install AdBlock, one of the most highly rated Chrome pop-up blocking extensions.

Click on the 'Add To Chrome' button next to the AdBlock extension, followed by the 'Add extension' button that appears in the Chrome security window. The extension should now be active, which you can check by returning to the extensions tab.

As with Adblock Plus in Firefox, you won't need to restart your browser, but you can if you wish. Either way, Chrome's AdBlock will now be active and will indicate so by displaying an icon in the upper right of the Chrome browser window.

IE/Edge

To check the default pop-up blocking settings in Internet Explorer, start by clicking on the IE menu in the upper right of the IE window – the topmost cog icon, not the one below next to your MS/Windows login name.

From the menu, click on 'Internet Options', followed by the privacy tab within the newly opened internet options window.

In the 'Pop-up Blocker' section, make sure the Turn on pop-up blocker option is ticked and, as with the previous two browsers, click on the settings button to make sure no sites have managed to worm their way in either accidentally or maliciously.

If you're using Edge in Windows 10, you can check the settings by clicking on the Edge menu button in the upper right – represented by three dots – followed by clicking on Settings in the drop-down menu.

Scroll down to the bottom of the right-hand settings window and click on the View Advanced Settings button. At the top of this section, you'll see a slider button labelled 'Block pop-ups'. Make sure it's set to the right, indicating On.

There are also add-ons available for IE that can extend the pop-up stopping technology of the browser. To see what's available, click on the 'Manage add-ons' option from within the IE setting menu. This will launch the add-ons window, where you can click on the 'Find more toolbars and extensions…' link at the bottom.

The top add-on for IE is Adblock Plus, which we used in Firefox. There are other pop-up blockers available, but for now we'll stick with Adblock Plus.

Click on the 'Add' button next to the title of the add-on, followed by the Run option in the security label on the base of the IE window. Next, click on 'Install', and Adblock Plus for IE will be installed.

After a browser restart, you should have the extra protection of Adblock Plus while using Internet Explorer.

Keep On Blocking

There are countless other software packages available that can block and stop unwanted pop-ups from appearing while you surf.

The trick, of course, is to find which works best for you. For the majority of users, though, these simple steps we've outlined here should be enough to keep the vast majority of unwanted pop-ups at bay and away from your browsing experience. **mm**
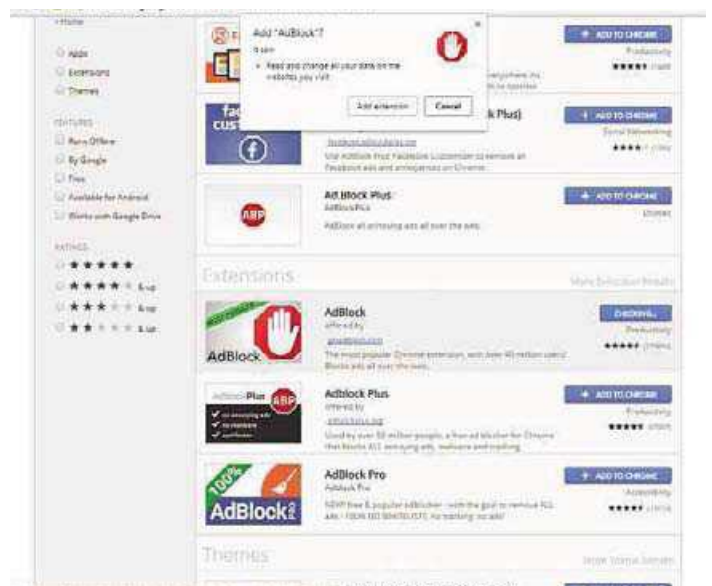
⌃ *Adblock for Chrome does a fantastic job of stopping pesky pop-ups*

Penny-Pinching Apps That Want To Save You Cash

Rob Leane explores the apps attempting to help with our finance management skills...

Between two-year contracts, expensive apps and data charges, you've probably grown accustomed to chucking cash at your phone. What has that money grabbing little brick ever done for you, though? Y'know, besides connecting you to everyone you know, allowing you catch Pokémon when you should be working and granting access to the biggest hive of information ever created?

I'd argue that it's time for our phones to start pulling their weight and helping out financially. Thankfully, some of the app developers of the world seem to agree. Here are ten apps that are all attempting to save you money in their own unique ways, and which you could really benefit from downloading...

Loot

Loot is arguably the ultimate banking app. Signing up for Loot's services means opening a MasterCard account, though, the app and allowing Loot complete access to see what you're spending money on. This may sound extreme, but it allows Loot's hi-tech spend-tracking code to monitor your outgoings and work out where you need to cut corners.

Loot will categorise your expenditure and show you which pillars of your life are costing the most. It'll also compare you, anonymously, to other users of the app. This lets Loot gain even more insights to share with you, such as areas where you're spending way more than the average person.

There are a few other tricks up Loot's sleeve, too. The app continues to work even when you travel abroad, and while you're away it will show you your balance in local currency. Alternatively, if you're trying to save up a certain amount, the app can adjust your daily budget accordingly and tell you what you can and cannot afford right now. Loot sounds very snazzy, and could be a lifesaver for the regretful frivolous spenders among us.

PayFriendz

One way to save money is to be frugal with your friends. If someone says they'll split the bill but don't have any cash on them, or if you lend someone money to get them out of a tight spot, you shouldn't just let that slide. If you find yourself in situations like this quite a lot, PayFriendz is the app for you.

PayFriendz aims to remove the awkwardness of owed money between mates by moving transactions out of the real world and into the digital realm. You and your friends can all create an account and connect up your bank details, and after that transferring money couldn't be easier.

You can message your chums through the app or even send them a more formal sounding 'request' for payment. When they see the message or request, they only have to hit the 'pay' button and enter the relevant details. You'll never be lamenting that lost fiver again, as long as your friends are cooperative.

▲ *Loot*

ATM Hunter

Here's a money issue that all of us have experienced at one point or another: not being able to find a cash machine, except for the ones that cost an outrageous amount of money to use. With ATM Finder, you can put the days of 'oh, sod it, I'll pay the £1.69' behind you.

ATM Finder helps you locate cashpoints near you and filter them by a number of parameters. These filters include surcharge fees, 24-hour access, wheelchair accessibility and the ability to make deposits as well as withdrawals. So, the next time you need to get cash out and there isn't a free or accessible machine in sight, don't give in and pay the fee; download ATM Finder instead.

Dice

Not unlike the feeling of giving up and paying the cashpoint surcharge, the hefty booking fees and delivery charges that come with buying event tickets online often seem like an unavoidable evil. Dice, however, is trying to change that – for live music at least.

> 66 **Next time you need cash, don't give in and pay the fee; download ATM Finder** 99

Dice is committed to charging "the price the artist and promoter intended you to pay and not a penny more." No booking fees. No hidden fees. Nada. You can't buy tickets for every gig through Dice, but some high-profile artists – Taylor Swift, Jamie XX and Jessie Ware, for example – have sided with the app.

So, next time you fancy some live music, it's worth checking out Dice to see what's available. You'll find a curated collection of concerts overseen by the team behind the app, and not even the faintest whiff of a booking fee. Wonderful stuff.

MySupermarket

MySupermarket is a service that you may have already heard of – they compare the prices of 13 supermarkets to make sure you're getting the best prices, be it for a huge weekly shop or just one item that you're really desperate for.

You can use MySupermarket online on your PC, or through an app on your phone. The process is the same either way: select the stuff you want to buy, and MySupermarket tells you the cheapest place to order it from. It will also let you know if there are similar but cheaper products you could switch in to make an even bigger saving.

That's not all, though! MySupermarket also regularly gets exclusive vouchers from the shops it compares. The savings just keep coming with this one, with the MySupermarket website claiming that you could reduce the cost of your grocery shop by 30% by utilising its services.

Spending Tracker

If the signing-up-for-a-new-card-and-sharing-all-your-details stuff has put you off the Loot app, Spending Tracker could be an alternative that's more up your street. It's simple, free, and you run it yourself – by recording your incoming and outgoing cash and seeing what's left.

Conveniently, it's divided up into months, to reflect the way most of our lives revolve around payday, but it's basically a smarter version of domestic accounting via a pen and paper. However, If you can commit to using this every time a penny leaves your bank, you'll never again be shocked to see how little you've got left at the end of the month.

▲ *Dice*

Like Loot, Spending Tracker also features categories. You can put all your spending into sections and see what's costing you the most each month. This can help you spot a problem a mile off and sort it out before it grows. As long as you're strict with logging absolutely everything, this app could really sort out your spending.

VoucherCloud/VoucherCodes

Vouchers save you money. Simple. Rather than shelling out top dollar every time you need to buy anything, keeping an eye on what vouchers are available could help you find a huge clothing discount, a cheaper dinner location, a cut-price hotel or a highly reduced flight (more on those later). There are countless spots on the web that will allow you to trawl for new vouchers, but getting an app on your phone to curate them for you arguably makes the whole experience of voucher hunting that little bit easier.

There are two main contenders to choose from: VoucherCloud and VoucherCodes. Both are free, so if you've got space on your phone, install them both and let the discounts roll in. You might also want to try the Taste Card app, specifically for restaurant discounts.

BigOven

A lot of money is spent on takeaways, usually immediately following the words "there's nothing in the fridge" . BigOven (which comes as a website and an app, depending on what's easier for you) is aiming to save you from reaching for the drawer full of local takeaway menus and indulging in unnecessary expenditure.

It's very easy to use: all you have to do is type in the uninspiring ingredients that are left in your sad-looking fridge. After that, BigOven will present you with a list of fun-sounding recipes using the leftovers and uneaten bits and bobs that you've got lying around.

It works, too. I just typed in 'cheese, ham, potato salad' and it actually came up with some yummy-looking ideas. By choosing to try one of them out, I could save the £20 cost of ordering a pizza. Thanks, BigOven!

CheckoutSmart

CheckoutSmart is an app that earns you cashback on your supermarket shops. After you've visited your local supermarket and made a purchase, you just need to take a picture of your receipt and upload to the app. CheckoutSmart will then work its magic, before rewarding you with dosh.

Buying certain items will earn you more cashback, and you can check a list of these (and how much they stand to make you) by briefly popping onto the app before you head out of the shop. Some items you'll get completely for free, once the cashback has been processed.

You might be wondering how an app like this could make any money, but it's not really about that. CheckoutSmart is based on the idea of your favourite brands 'rewarding' you for a purchase. You may not get a free bottle every time you buy Coke, for example, but sometimes you will. This one's definitely worth checking out if you're a big supermarket shopper.

Minicabit/Hotel Tonight/SkyScanner Flights

If you're the type of person that needs to travel around a lot, the costs soon add up – but as with most problems in the 21st century, there's an app for that. There's more than one, in fact, but we've rolled them into one section here to save you some reading.

Arriving somewhere unfamiliar and needing to book a taxi can often burn a big hole in your pocket. If this happens to you on a regular basis, try out the Minicabit app. It might not be as much of a household name as Uber, but it doesn't come with those surcharges and varying price levels. Plus: Minicabit works everywhere, not just in select cities. Once you tell the app where you need to go, it'll quickly come back with a selection of quotes from local licenced Minicab firms. This can be really handy to avoid getting mugged off, which is always a fear when you're not sure what the regular rate is somewhere.

Hotel Tonight could save you a mint if you need to head away somewhere and staying over is mandatory. You can actually get some very good deals, because, at the last minute, most hotels would rather have full rooms than empty ones.

SkyScanner is one of many price comparison services that offer insights on cheap flights, but is has more pedigree than most (it's won tonnes of awards) and more flexibility (it's available both online and as a mobile app). If you're looking for a flight last minute, then, don't go assuming all the prices will be terrible. Try SkyScanner instead. There's a good chance it'll find you a deal from an airline with a seat to fill.

So, there you have it. Whether you're planning a weekly shop or a jaunt across Europe, there are apps that can save you money. There are also a few options in the world of personal budgeting apps, whether you want in-depth assistance or simply somewhere to log everything. There are also vouchers, ways to avoid surcharges, and even an app to make your leftovers go further. Maybe your phone isn't such a sinkhole for cash after all. **mm**

The Sun-worshipper

The Weekender

FREE
portable
speaker*

The Explorer

The Adventurer

SAVE
up to 50%

Whether you'll be sitting on a beach or going on an adventure this summer, we have a magazine for you in our SUMMER SALE!

SAVE UP TO 50% and receive a **FREE** portable speaker – the perfect companion to any summer read

magazinedeals.co.uk/summersale

01795 592 910 quote code: **P1610PSC**

*Gifts limited to the first 1000 orders only. Please allow 28 days for delivery. UK only offer. Alternative gift may be supplied

Alphabet Pi: W

David Briddock meanders through Raspberry Pi technology from A-to-Z

THIS WEEK: Wales Sony Plant, Wayland Graphics, Wolfram Mathematica and Windows 10

Wales Sony Plant

The very first Raspberry Pi boards were made in China, but quite quickly production moved to Sony's Pencoed manufacturing facility in South Wales.

Just 12 months later, one million Raspberry Pi boards had rolled off the Welsh production line, but that was just the start. By early 2016, the Raspberry Pi Foundation had sold over eight million Pi boards.

It's a magnificent British manufacturing achievement to have so many 'Made in UK' Raspberry Pi boards floating around the world, and each member of Sony's Pencoed workforce is justifiably proud of their productivity and quality figures.

> **66 By early 2016, the Raspberry Pi Foundation had sold over eight million Pi boards 99**

Sony uses only the best-quality components, and quality is maintained through an Automated Optical Inspection (AOI) stage, a high-resolution camera with intelligent image processing software and a battery of 'power on' tests in specially designed test rigs.

Wayland Graphics

Raspberry Pi owners always welcome improvements to graphical performance. However, the X11 windowing system has been identified as one of the main barriers to further improvement. In a nutshell, X11 isn't optimised to use the video core processors built into the Pi's Broadcom chip, so the main ARM processor has to undertake the graphics rendering instead.

To fix this problem, the Raspberry Pi Foundation has decided the way forward is to bypass the X11 architecture completely. And so, at some point, the official Raspbian distribution image will implement the open-source Wayland protocol (**wayland. freedesktop.org**).

Unfortunately, this isn't a speedy process. Raspbian's current LXDE shell runs X11 just fine but doesn't support Wayland. And those desktop shells that do, such as GNOME, for example, are too heavyweight to run on some Raspberry Pi models.

Therefore, the Raspberry Pi Foundation has been working with software outfit Collabora (**collabora.com**) to develop

▲ *Sony's plant at Pencoed Wales*

a lightweight Wayland shell. Called Maynard, it's hoped this shell will offer graphical throughput speeds of between 500 megapixels and one gigapixel per second. Meanwhile, legacy X11 applications will be supported by the XWayland component.

Wolfram Mathematica

Since late 2013, the official Raspbian distribution image has included the Mathematica app and the Wolfram Language. This is a very high-level language where a line or two of code can solve a wide variety of computational problems.

Wolfram Research (**wolfram.com**), which developed the software, is widely known for a computational knowledge engine called Wolfram Alpha. Alpha is used by students to turn complicated homework problems into step-by-step solutions.

The Pi edition includes the full system, all 5,000+ Wolfram Language functions, the full Mathematica app and its notebook interface, plus GPIO connector support. There's a list of Pi-centric examples on the Wolfram Community website (**goo. gl/4kEp9w**).

Windows 10

Since the middle of 2014, the Raspberry Pi Foundation has worked closely with Microsoft to bring Windows 10 to the Raspberry Pi. Its slimmed-down Internet of Things (IoT) Windows 10 Core (**dev.windows.com/en-us/iot**) operating system is aimed at the more powerful Pi 2 or the even faster Pi 3.

If you want to give it a try, the installation instructions can be found at **goo.gl/BH9Zb6**. And Adafruit has a handy Starter Pack (**goo.gl/jhNth4**) that provides everything you need to build five Windows IoT projects and ideas for several others. **mm**
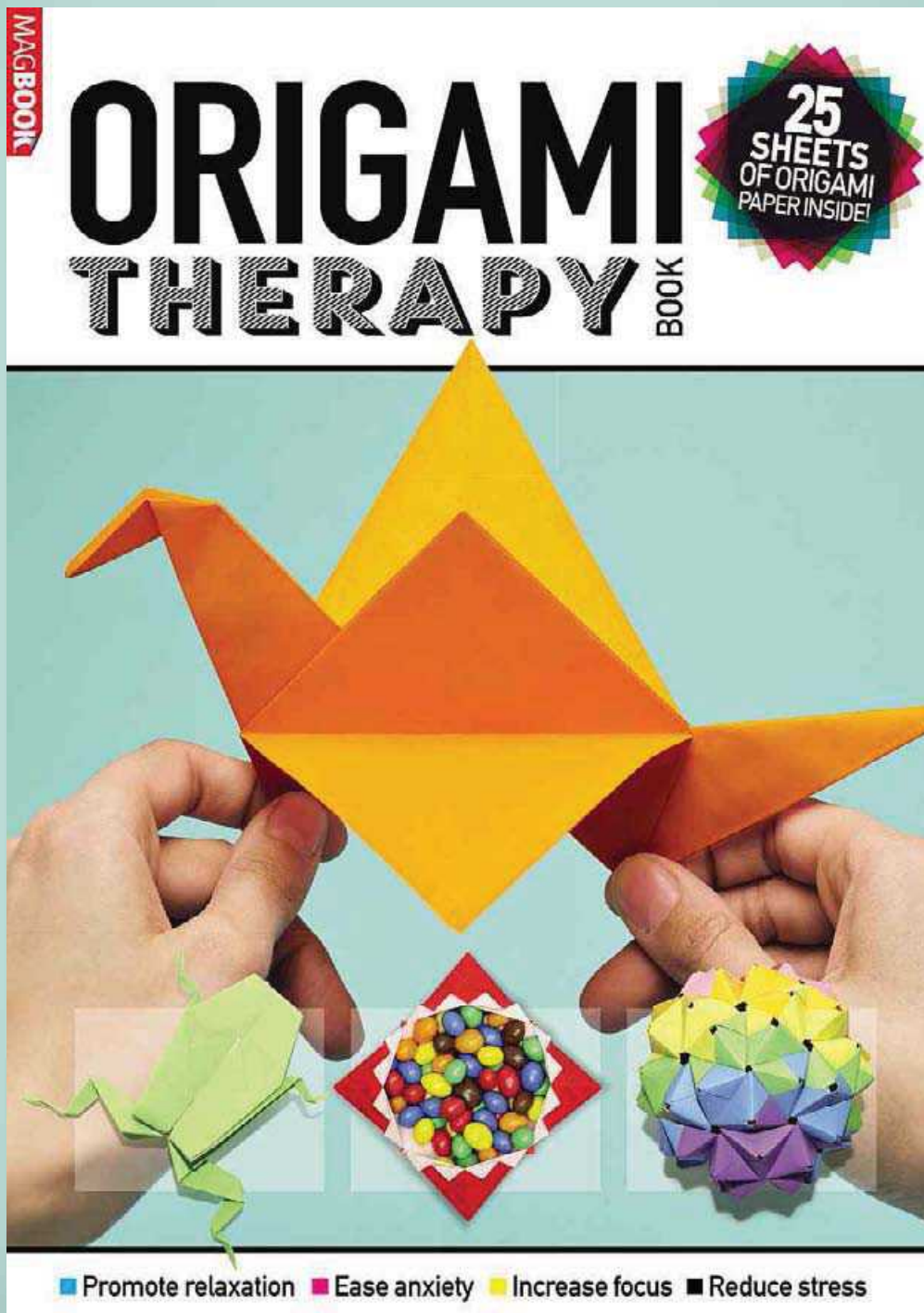
How To Factory Reset A Laptop

Is your Windows installation flagging? Restoring your computer can fix the problem

Pretty much every modern device is able to be returned to its factory settings with very little effort, and that includes laptops. By factory settings, we mean the state the device or laptop was in when you got it from the shop or when it arrived on your doorstep.

This means, from the point of view of laptops, the version of Windows will be set back to the initial state, as will any programs that originally came with the device that you may have removed over time.

There have been various discussions over the years as to how a computer starts to slow down after a period of time. It takes a little longer to boot and it doesn't feel quite as responsive as it did when you first powered it up. As we said in the past, this is due to the operating system creating broken registry links, software not being uninstalled correctly, temporary files being created and so on.

It's no one's fault; it's just something that happens. But thanks to many laptop suppliers these days opting to include a method to restore systems back to their factory settings, the process of returning laptops to their former glory is relatively easy. It just depends on what make of laptop you own.

Different Manufacturers, Different Methods

With each laptop sold, the manufacturer creates its own restore partition on the hard drive of the machine.
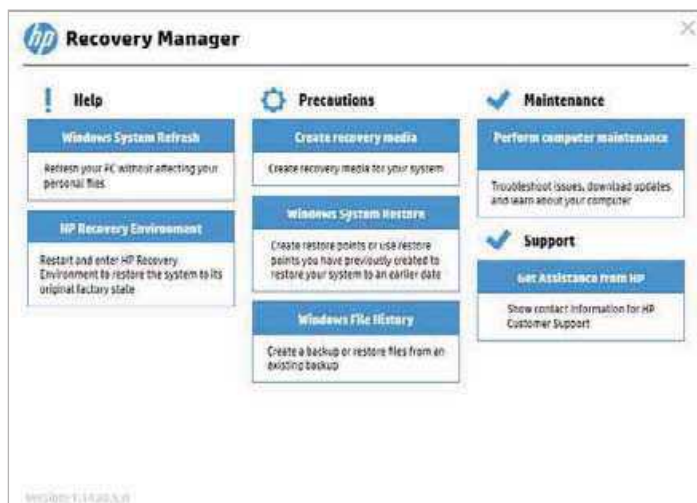
↑ *The HP Recovery Manager does an excellent job of guiding you through the process*

The restore partition is a hidden area on the hard drive, where a backup of the operating system and all the programs that came with the laptop are stored. The OS backup in the restore partition contains all the necessary drivers and any updates that were available at the time the laptop was sold. So if you're doing this a year down the line, you can expect that there will be several extra Microsoft specific and individual driver updates that will need to be applied once the laptop has gone through the restore process.

What we're getting to here is the fact that although the system will be restored to its original state, any work, files and programs you've added since then will be wiped.

Therefore, before you commence with a laptop factory reset, it's best you make sure you've backed up all your work and files, and that you've made a note of the programs you've added during its use. Also, you'll need to back up your internet browser favourites, as they too will be removed with the factory reset.

It's also worth noting that the method of restoring laptops to their factory state can be called something different by various manufacturers. Some refer to a restore partition, while others will call it a recovery partition, recovery manager or factory image restore. It really all depends on the make of the laptop.

The Factory Reset Process

Since the process is slightly different for each laptop, we've tried to come up with a generic model of accessing the restore partition and getting the original operating system image back.

As you may expect, we can't cover all the bases, so you'll need to double-check with your laptop manual and supplier how to restore to the factory settings, should the method below be radically different from what you're experiencing.

From this point on, we're assuming you've backed everything up. To begin with, power up or reboot your laptop, and during the initial start up process – before it starts to boot Windows – press the appropriate F-key as the manufacturer logo appears on the screen.

For Dell and Alienware laptops, this is usually the F8 key; for Acer it's an Alt and F10 combination; for Sony laptops it's often just F10 on its own. HP and Lenovo laptops generally use the F11 key, whereas Asus, MSI and Samsung laptops use F9, F3 and F4 respectively.

You'll need to consult the paperwork that came with the laptop, but some manufacturers briefly display the key or

combination of keys to press while the company logo is present on the screen.

With the correct key or key combo pressed, you should now be looking at a basic menu with a set of options. Again what you're seeing is going to be different from one laptop model to the next. There are even differences within the manufacturer depending on the age of the laptop and the version of Windows it ships with, so be prepared to spend a moment or two here to work out where to go next.

The options will often display a mixture of running a system health check or restoring/recovering to the factory reset. They're mostly self-explanatory, but again consult your laptop's paperwork or have a look at the company support site for specific information regarding which option you'll need to reset the laptop.

Once you've picked the appropriate option, you'll probably be asked if you're sure this is what you want. If you are, then click or press Enter to select 'Yes' or 'OK', and the laptop will start its automatic restore routine to factory reset.

For the most part you won't have anything to do during this process, other than watch a bar or percentage graphic gradually fill up to 100%. There's a good chance that the laptop will restart several times during the process too. All you need to do is leave it alone, plugged into the power and doing its thing. (You don't want to run out of battery midway through the process as that could have drastic consequences for the system restore.)

Start All Over Again

The factory restore process can take anything from half an hour to well over an hour. It depends on the speed of the laptop and the size of the recovered factory installation of Windows.

Once it's done, however, you'll be presented with the initial Windows prompts to set up a new user account, since yours will have been wiped. All you need to do then is create your Windows account and copy back over all your work you've backed up. Also, run the Windows update for any new additions since you first bought the laptop, as well as new driver updates, then reinstall any programs you've added and restore your browser bookmarks.

It could take the best part of a day to get everything back to the way it was previously, but the laptop will be a clean build and will most likely perform better. **mm**

Another Possible Method
Before we leave you to your factory reset, it's worth mentioning that the manufacturer may have included another method to factory reset your laptop.

There's a good chance that the manufacturer has installed a program on the laptop, within Windows, that can do everything you need without you having to access the recovery partition.

The HP Recovery Manager is a good example of this. Once run from within Windows, you'll get a menu with several options.

The option you'll need in this case is the HP Recovery Environment, which will restart the laptop and enter the restore partition as described in the main body of this article.

How To Copyright Your Images And Writing Online

Rob Leane takes a look at the world of online copyright, with some tips about copywriting your photos and words...

The internet is a huge frontier filled with information, images and ideas. Ideally, in this vast digital landscape, you'll want to make sure that your own property is protected. Legally, the photographs you take and the words you write should be yours, unless you're knowingly snapping/penning them in the employ of someone else.

When you share images and words online, then, it's understandable that you won't want anyone else repurposing them without your permission. That's why we have copyright laws. So, if you're wondering how to ensure that your photos and your words are copyright-protected in the online realm, read on...

Images

Here's the good news: your photographs are legally yours already. Copyright is automatic. A photograph becomes your legal possession at the very second of its creation; the moment when you press the button to take the picture. It doesn't matter if it's a smartphone camera, a digital camera or a film camera.

The only reasons these rules wouldn't apply are if you took the photo under the employ of another entity (e.g. you were a photographer on an assignment for a magazine), or you signed an agreement before or afterwards where it was made clear that the rights would not be yours (e.g. as a pre-requisite to attending an event, or you sold the photo to a company for use in an advert after the fact). The general rule of automatic possession became the law in the UK in 1989. Generally speaking, the rights to a photo remain with the person that took it until 70 years after their death.

There are still ways to be extra-cautious with your photographs online, though. You could check your Facebook settings to make sure your photos aren't posted outside of your friendship community, for example. Or you could state your copyright ownership in writing alongside an image, to make it extra clear. Something like "© 2016, Rob Leane", but with your name instead of mine (obviously), would probably do the trick.

There are also plenty of services online that allow you to add watermarks to photos. These are popular among professional photographers who, understandably don't want people to take and use their snaps without paying.

There are also websites (like **CopyrightService.co.uk**) that allow you to register photos as your copyrighted work, meaning you have an extra layer of proof that this photograph legally belongs to you. This can be handy if you ever end up in a legal battle against someone who used your picture without permission, but is entirely optional.

It's worth noting that the rules were different prior to 1988. Back then, whoever produced the material on which the photograph was taken (i.e. the physical film/negative itself) also had a cut of the copyright.

Writing

If you are writing something on your computer of your own volition (be it a blog post, a novel, a poem, or anything else you can dream up), it' too is legally yours automatically. Similarly to the photography copyright laws explained in the previous section, any original works you write become yours at the very second you type them. You can make this extra clear when you're publishing your work online, by marking it with the copyright symbol, the year of creation and your name. You often see this at the bottom of websites.

Again, this became the law in 1989. Also, similarly to the rules governing photography that we've already discussed Copyright on written work remains with the writer until 70 years after their death.

The same exceptions as apply to photographs also apply here: if you're writing under some sort of employ (as a staff writer for a website, or a novelist under a contract), your employer will often own the copyright. It's always worth checking the contract if you're signing up for a writing job. Similarly, if you write something for yourself but sell it to another body later, they will generally then hold the rights to it. Again, it's important to check before you sign anything.

Unlike the USA, the UK does not have a government-managed register of copyrighted works to use for reference. The Intellectual Property Office (IPO) is a branch of the government that offers some advice on the matter of writing copyright, but the only registrations you can make through the IPO are for inventions that you've designed and need to patent.

However, again, there are ways to doubly protect your writing should you wish too. Websites like **Copyright.co.uk** offer services where you can register your works, meaning you have proof of the copyright if it ever comes into dispute. This can be advantageous, as saying 'I wrote it first' isn't going to be enough to convince a court of law if you've lost the original file because your computer broke.

Yes, it's entirely optional if you want to add a copyright logo to your blog or sign up for the services of a Copyright registration website. In legal terms, your writing is legally yours as soon as you type it anyway, as long as you aren't doing so under someone else's employ and you didn't steal the text from anyone else.

When It Goes Wrong

If you Google search 'how to enforce your copyright', the first thing that comes up is a link entitled 'Enforcing your copyright - Detailed guidance', from the UK government's official website (**www.gov.uk/copyright/overview**). If you think someone has infringed upon your intellectual property – be it your photos, writing or anything else – this is the best place to start.

Before you even consider getting a lawyer, it's worth checking the 'Exceptions to copyright' that you'll find on this Gov.uk page. These include private study by universities and academics, teaching, helping disabled people, parody/review/criticism, and news reporting.

In all of these fields, it's legally acceptable for people to reproduce sections of your work. In some cases, reposting the entire thing wholesale is also acceptable. They must always give you credit, though, and it's worth going online to check if you've seen your work pop up somewhere and you're in doubt about the legality.

If you've checked the Gov.uk website's list of exceptions and still believe you have a case, it's best to contact the offending party and see if you can reach an agreement. Will they pay your desired fee for using your photo/text? And if not, will they remove it at the earliest opportunity?

If this doesn't work, the government's Intellectual Property Office can provide a mediator to oversee a more formal discussion – either via phone or in person – to help you solve the dispute. You can find more information about this online.

If a friendly chat and a spot of mediation don't do the trick, the only option left is to take your dispute to court. Things may start to get expensive at that stage. And again, more information can be found at Gov.uk's 'Enforcing your copyright - Detailed guidance' page. You'll also find information on how to register a trademark on Gov.uk, if that's something you ever need to do.

In Conclusion

Unless you took a photo/wrote a piece of writing under the employ of another entity, or you sold the rights at some point after the photography/writing took place, you hold the copyright. It's automatically your intellectual property, as long as you haven't plagiarised it from someone else. To make this clear, display the copyright symbol, the year and your name alongside the photo/writing when you decide to post it online. You can back this up with the help of a copyright registration company, but this is completely optional (and it's always worth doing some research to make sure the company in question is legitimate).

Being aware of these copyright laws, and stating your ownership whenever you post your work, is the best way to be prepared. Just in case anyone ever tries to steal your stuff. **mm**

All That's Green In The E-Garden

Technology is now flowering in places it previously shunned. Mark Pickavance looks at what you can use to help make your fingers that little bit greener

I'm not sure why, but as I get older, I'm more interested in growing things rather than watching them wither and die. And while I'm not yet an avid gardener, I've always got a few plants that I'm cultivating either inside or outside the house.

The problem with keeping them alive is that plants aren't a species that communicate well with those tending them, and it's frighteningly easy to over or under water, feed them wrong, or just hasten their demise through the general distractions of life.

I'm not terrible at letting things die, but it can happen. And when you've spent some not considerable time, money and effort growing something from a seed, that outcome can be very disheartening and more than a bit annoying.

While I'd be one of the first people to accept that technology doesn't solve many problems (and causes plenty too), I was interested to see what help it might be in providing an edge for the struggling gardener.

A Blooming Market

Go back a few years, and automated feeding and watering systems were the territory of professional growers, but we've seen all that change in the past couple of years.

Depending on how much money you wish to invest, you can get very simple systems that just deliver water or feed on a daily basis using a timer, or more complex solutions that are IoT (Internet of Things) connected.

What I'd like to do in this feature is cover some of those in detail, and also talk about another I've tested and what else is available on the market.

> 66 **It's frighteningly easy to over or under water, feed them wrong, or just hasten their demise through the general distractions of life** 99

What I won't be mentioning here is the possibility of building your own solutions using widely available components, but you can do that too.

Most of the technology I'll talk about uses technology like Arduino and freely available sensor chips to make what most enthusiasts could achieve with relatively little effort. But obviously the makers of these products have solved some of the critical problems, like how to keep water out, along with building the mobile apps needed to control them.

Maybe I'll create my own plant monitoring device in a future issue of Micro Mart, but in the meantime, here are some devices you can buy for yourself.

The Hozelock Cloud Controller

Garden watering is pretty much synonymous with the Hozelock brand ever since its clever connectors invaded the majority of UK
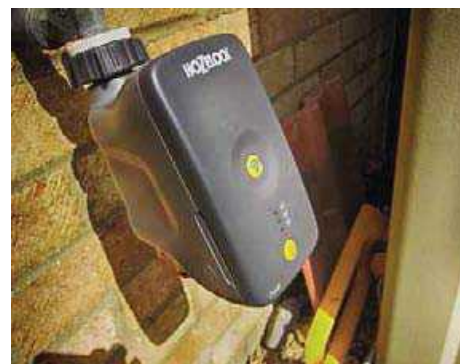
gardens. It's made all manner of watering solutions over the years, but now it's started to explore technology as a means of delivering water to growing plants without direct human intervention.

The Hozelock Cloud Controller costs around £100, and it can be found with the Easy Drip kit, which it sent me along with it, for about £125. The device has two components: a small Hozelock Hub that connects to a wired network point, ideally your router, and the actual control box itself that you screw onto the external tap using one of a selection of plastic adapters Hozelock provides with it.

Once you've attached the controller, you need to open the tap, and allow it to control the flow of water. If this sounds a bit problematic for those going on holiday, Hozelock states that should the batteries fail, the valve will shut, thankfully.

As an override to handle manual events, the controller has buttons on it that allow you to demand 10-, 20- and 60-minute flows whenever you need them.

Before deployment, you need to first get the small box talking to the internet, and then insert two AA batteries (not included) in the controller.

If the system used wi-fi, then there would be little point in the hub, so I can only conclude it uses some sort of ZigBee communications. To pair the two parts, you need to use a mobile app on either an Android or iOS phone or tablet, and it's through this software that you can control the flow of water once pairing is established.

Initially, this worked really well, though I was a little confused, because selecting watering on the app didn't actually immediately initiate it on the controller.

In the default mode, the controller only links to the hub (and therefore the internet) every 15 minutes, to conserve battery life and, therefore, depending on exactly when in the cycle your instruction is issued, it could take a while to respond. There's a more rapid polling that Hozelock call 'immediate', although this does use up the batteries more rapidly, obviously.

The only problem with this product is if the hub and controller get disconnected for whatever reason – something that happened to me a number of times. It seems determined not to reconnect, forcing you to go through the pairing exercise again.
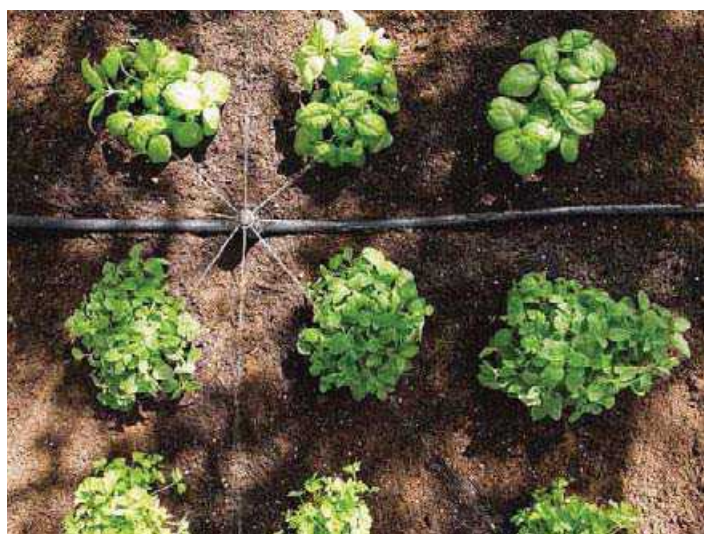
Eventually, mine got so mixed up, it appeared four times in the app, as if it was four controllers, and still refused to connect correctly. I asked Hozelock support for help and they sent me a 21-step guide to factory resetting the controller, hub and app, which actually cured the problem.

While I'm technically able to follow what is a reasonably complicated procedure, I'd suggest that for the average customers, a button marked 'reset' would be a much better alternative. I'd also contend that both the controller and its app need some work to achieve the job more elegantly. Surely all controllers are uniquely numbered, so why would the software allow you to register the same one multiple times?

What the system does well is allow you to create a watering schedule that fits your exact needs. By default, it sets up a ten-minute flow at dusk and dawn, but depending on your local weather forecast, it can throw in an extra watering if it gets very hot in the day.

◄ *Parrot Flower Power*
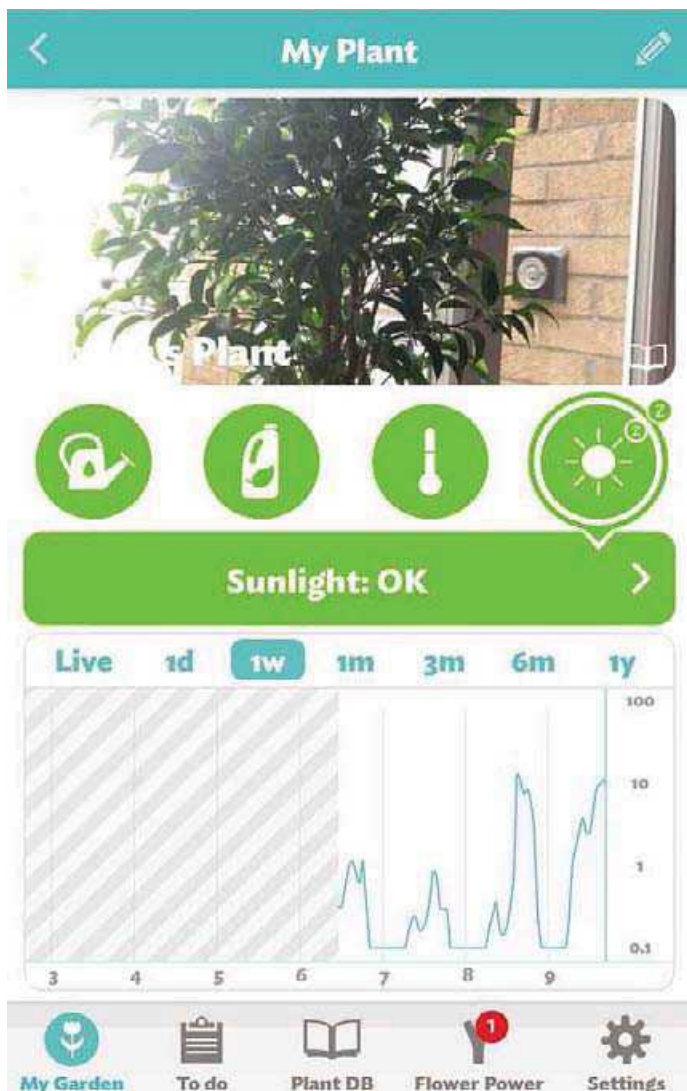
And you can demand watering from any internet-connected location on the planet, should you decide it's necessary. This is what makes the Cloud Controller better than the simple timer that Hozelock will sell you for about a third of this price.

The obvious problem with this scenario is that it assumes all your plants need exactly the same watering amount and frequency, though you can connect up to four controllers to one hub, I'm told.

Part of the solution to this is the EasyDrip Micro kit that Hozelock provided for me to test this hardware, as it allows you to provide differing amounts of water to multiple locations.

In the EasyDrip Micro Kit box is 15m of 4mm flexible cable, a pressure reducer, T pieces and 15 micro drippers. With this connected to the controller, I was able to specifically water 15 plants and control exactly how much water each got.

The micro drippers can be adjusted from almost zero to 20 litres an hour, though some guesswork is required to work out the right amount for each scenario. I recommend plumbing it all in and then using some pint glasses with the drippers to see how much they output in a 10-minute watering cycle.

For those with a bigger watering problem, Hozelock does make larger gauge versions of the EasyDrip system, which can sprinkle whole sections of a flowerbed in the same manner.

Where I'd suggest these solutions really come into their own is for those watering in a greenhouse, where they'll get no natural rainfall, and also for hanging baskets, where they need lots of water on a regular basis.

What it lacks badly is any feedback system, whereby you could link a probe that tells the controller when water is required or actually when not to water. I'm sure Hozelock will be considering this, because with this relatively minor addition, the Cloud Controller would be elevated from something you could use to water while you're away or busy into a full propagation enhancement tool that many gardeners would really appreciate.

Parrot Flower Power

I reviewed this a few months back, but it's a product worth considering for those with a special plant or in a scenario that requires specialist care. Looking rather like a plant stem that's been overly enthusiastically pruned, the Flower Power uses a single AAA battery (included) to provide monitoring of soil conditions for both moisture and mineral content, along with sunlight received.

To communicate this to you, it uses the low-power version of Bluetooth, so it requires either a Bluetooth-LE-enabled phone or tablet to establish that link.

Where this product is exceptional is in the software that Parrot has created for it, with which you can register the plant with a picture and then build a profile of its status and needs. Using this data, it can tell you to relocate the plant to a sunnier location or provide more shade, based on the plant type and existing conditions. There's a vast database of common house and garden plants in the system, and you can add your own special varieties if yours aren't there.

This is all good, but where it all rather falls down is in respect of the acquisition of data, because if you don't go within Bluetooth range of the Flower Power and run the app, it won't be updated, and your plant will effectively be ignored.

As if to highlight this flaw, the Flower Power I reviewed long ago returned to Parrot, yet I still have the app on my phone, and it hasn't mentioned once that perhaps I should go check the plant.

My initial thought about this device was that it was designed to prevent people forgetting to water and feed their plants, but it doesn't solve that problem for those who have a tendency to be interesting one week and less so the next.

Edyn Garden Sensor

What Parrot needed to do was make a wi-fi to Bluetooth adapter so that the Flower Power is regularly polled and so data is shipped to the cloud for alerts to hit your phone telling you to water the plant and so on. If it did this, then I'd certainly have one of these, if only to help house plants through the difficult stages after repotting, for example.

The RRP of the Flower Power is £40, though I've seen you can get them for a little less if you hunt around.

I suspect that like many of Parrot's products, the second generation of the Flower Power will deliver more on the promise that the existing solution made but doesn't really deliver.

> **❝ What the system does well is allow you to create a watering schedule that fits your exact needs ❞**

Edyn Garden Sensor

I haven't tried this out yet, but on paper it looks very promising, even if it did initially start out as a Kickstarter project.

Stylishly designed by Yves Behar's Fuseproject studio, the Edyn Garden Sensor monitors soil nutrition, ambient light and temperature, relaying that information over wi-fi, where you can access it from your Android or Apple phone. Unlike the Flower Power, this is a large probe that isn't really suitable for house or potted plants and is more at home in the garden.

The flattered rectangular head contains a solar panel that's meant to recharge the internal power pack that Edyn claims will last for about 30 months. You can't replace the battery, so I assume you bin it after it will no longer hold a charge.

From what I'm told by others, the Edyn Garden Sensor is a fine piece of hardware that is rather undermined by a poor and unresponsive phone app. Often the push mechanism of the data updates appears to fail, and the database of plants supported isn't anywhere as extensive as that of the Parrot Flower Power.

In addition to the Garden Sensor, Edyn also has built a solar-powered watering valve. When the sensor decides that the soil is dry, watering can be automatically initiated using the valve, creating a controlled feedback loop.

At this time, you can only get the Garden Sensor on import, and you'll be paying at least £115 for what sells for just $99.99 Stateside. The valve is another $59.99, should you want the full experience.

When it comes officially to Europe, one can only hope that the software side of this device has been addressed, along with the dubious battery replacement model.

Koubachi Wi-Fi Plant Sensor

There are similarities between this and the Parrot Flower Power. But instead of going down the Bluetooth route, Koubachi decided to make its device big enough to take two 1.5V AA batteries and gave its devices the option of wi-fi. Because of that, this gizmo is really for indoor use, as it's only 'splashproof' and not designed to be outside when it's raining.

Where this system is excellent is in the number of plants it can handle, because up to 27 plant sensors can be deployed and controlled with a single phone app or web interface.

Its weakness is that the wi-fi technology used is really old 802.11g (actually a+g), which some routers won't support by default and some mobile devices no longer use.

Many users of this really like the supporting app, because once you've identified the plant it's taking care of, it provides all manner of information about watering, misting, fertilising and adjusting light and temperature levels.

▲ Koubachi Wi-Fi Plant Sensor

▲ *Oso Technologies PlantLink*

Unfortunately, the database only contains 800 plants, compared with the 5,000 of the Edyn and the whopping 7,000 of the Flower Power.

However, a major downside to the Koubachi is that the company that originated it no longer exists, having been folded into the Husqvarna group a while back.

The Koubachi website tells you that it won't shut down its systems until 2018, though I'm not sure I'd recommend spending £90 on this for that relatively short period of guaranteed functionality.

From all accounts, those who used this device liked what it did, so the fact it's going to disappear is something of a disappointment to them.

Oso Technologies PlantLink

Yet another device that started as a Kickstarter campaign, but this one has progressed beyond that point significantly.

The elegance of PlantLink is that it separates the need for internet connection from the sensor, allowing that to be small and yet still remain connected.

The sensor part is also designed to be both an indoor and outdoor device, so it's as suitable for a hanging basket as it is for a house plant. And you can use up to 64 sensors with a single Ethernet-connected base station.

Where this design deviates from what many others offer is that this hardware only monitors soil moisture levels, telling you when to water. All the other aspects like the amount of sunlight and nutrients in the ground are your problem with the PlantLink. What it also doesn't tell you is how much to water, other than your plant needs some that day.

The best aspect of this hardware is the cost, because the base station and sensor kit is about $60, and the sensors are just $35 each. Unfortunately, they're not widely available in the UK, which is why I haven't quoted sterling costs.

That's regrettable, because while it's only a watering aid, the design of the PlantLink avoids the obvious mistakes that Parrot made with the Flower Power, and it managed to keep the unit costs right down.

Click & Grow

This isn't a single product but a whole range of them, all based on the growing of small plants with the least fuss imaginable. The concept behind them is simple: it's a fire-and-forget system

for growing, where each smart pot contains everything you need to grow.

Each kit comes with 'plant cartridges' for a specific plant or herb, like basil or strawberries, and all the compounds needed to make it grow. You simply insert four AA batteries into the growing container, fill the water reservoir and then peel off a sticker on the

> 66 **The ability to go away on holiday and not come back to complete carnage is wonderful for anyone who loves gardening and plants** 99

cartridge to kick off the growing. LEDs on the Smartpot tell you when to add water, and that's about it.

Normally you'd need a sunny place, but Click & Grow has even considered that and winter growing with a mains connected version with its own LED lighting. Using this, you can have herbs right through the winter, without the need for sunlight.

As much fun as idiot-proof growing is, the technology in these things is all in the formation of the cartridges, and a little in the water monitoring. The Smart Herb Garden kits with their own lighting have a little more to them, but their simplicity is part of the charm.

Once a plant has exhausted itself, you can buy replacement cartridges, and in the models that take multiple ones, you can mix and match the plants. A simple Smartpot to grow mini tomatoes, for example, costs about £40, and one with its own light generation starts at about £60, going up to £100-110 for the biggest kits.

This is modestly more high-tech than planting seeds and crossing your fingers, but only just.

Click & Grow

The Flower Power by Parrot

• Monitor your plants' health directly from your smartphone.
• Flower Power App - Real-time alert of your plants' needs.
• Precision farming is at the tip of your fingers.
• The very latest generation of plant care.
• Easily take care of your plants on a daily basis.

Final Thoughts

The products I've looked at here are interesting, certainly have application and can be very useful, especially for the gardener who isn't home to look after their plants 24/7. Unless you're retired, that's going to be the majority of people who garden.

The ability to go away on holiday, for example, and not come back to complete carnage is wonderful for anyone who loves gardening and plants.

But what we also need to realise is that these initial solutions will soon be overtaken by more sophisticated ones that close the circle of tending and sensing, allowing the garden to effectively look after itself once configured.

The cost of this gear is also likely to reduce dramatically, as more products come into the market and the ranges of what's available expand. With IFTTT functionality it should also be possible to marry a feed/watering system made by one company with sunlight and ground mineral sensors from another, and create a unified solution. That also opens up the possibility of 'per plant' based monitoring and support that serious growers need and will soon expect.

Ultimately, I expect that the humble greenhouse will be replaced with a hydroponics cylinder or box, whereby you install those plants and vegetables you want to grow in it, and then the

internal systems take over and care for them. They'll alert you when your produce is ready to harvest or when capacity is ready for replanting.

None of this is especially radical, as all the technology to make these ideas work exists today. It just needs a company to design a modular carousel solution with integrated support technology to make it a reality.

Another problem that many of these systems seem to run into is using wireless communication in a way that works seamlessly from the inside to the outside of a house. Obviously, mounting antennas on the outside is part of the solution, though there may be other ways to achieve more reliable communication.

Perhaps what hardware makers need to consider is that if you're deploying multiple devices, then it should be possible to make them work as a wider intranet, allowing the one with the best connection to the house network to act as a relay for others further away. Again the technology to achieve all this is readily to hand, if people would just consider deploying it in an affordable package.

My only problem with e-gardening is that the act of gardening is as much about getting outside and connecting with nature as it is about growing things.

It's for each person to decide where the value comes in having these systems and to choose what they do with the free time that having their plants watered automatically allows them.

For some, it might actually be underlining the point of the time they spend in their gardens, and for others it allows them to grow things with less direct intervention. **mm**

Is Augmented Reality About To Take Over?

As Pokémon Go takes the world by storm, Rob Leane wonders whether AR is the future of our phones and society at large…

Augmented reality (AR) – the feature that allows *Pokémon Go* to plonk pocket monsters in the real world through the screen and camera of your mobile – is nothing new.

For instance, when the Nintendo 3DS launched in 2011, it came with built-in augmented reality tech and a few little games you could play using physical cards that the device's camera interacted with, bringing them to life in interesting ways on your screen.

Pokémon Go proved to the masses that smartphones are capable of utilising AR, but even that wasn't new information to savvy gamers. *Pokémon Go*'s developer, Niantic Labs, had already been using AR on mobiles with its previous game, Ingress, which

launched in 2013. That's not to mention games like *Blippar* and *Zombies, Run!*, which are also built around AR and have been available for ages.

But now the success of *Pokémon Go* has put augmented reality on the map, right at the heart of public consciousness around the globe. Is this tech about to explode? And when it does, what will the world look like? We had a think…

More AR Games

The most obvious way in which AR could take off now is in the form of mobile games attempting to piggyback *Pokémon Go*'s success. To truly follow in the footsteps of Niantic Labs' mega

hit, developers arguably need to follow suit by pairing up with a recognisable brand and finding a way to make it fresh again in an AR and/or location-based gaming context.

There are loads of established intellectual properties that could translate well into the world of AR gaming apps. *Uncharted*, for example, could work marvellously as an interactive AR game. The immensely popular PlayStation series is all about exploration exotic locations, fighting bad guys and uncovering treasures. It's not hard to imagine how an AR version could work, with obstacles and treasures placed strategically around real-life locations to encourage players to get out and find them using the GPS and AR functions of their phones.

Watch Dogs – which is all about tech geniuses who move throughout cities and hack into the servers of their enemies – is another game that could move over to an AR app very nicely. A mobile version, where fictional evil companies are positioned around your city and you have to try to bring them down, could really capture the imagination of gamers.

Or what about *Hitman*, the stealth-based game where players have to sneak up on targets and murder them for money? An app that litters made-up targets throughout you local community, with the aim being to approach them without being seen before virtually completing the hit, could add a whole new side to AR gaming. *Pokémon Go* is anything but a stealthy activity, after all.

A great AR game could also be made around the post-apocalyptic *Fallout* franchise, by digitally transforming the world around us into a dystopian wasteland that you need to traverse without dying. It would be a much larger AR undertaking than placing the odd Pokémon here and there, but it could be a huge success if the developers managed to pull it off.

Given the popularity of superheroes right now, DC Comics could do a lot worse than building up an AR game as well.

Imagine an app where you had to pick a side between iconic heroes and villains, building factions to fight for Batman, Superman, the Joker or Lex Luthor in the ongoing struggle between good and evil. That could be great.

As it stands, though, no gaming app developers have stepped up and formally announced a clear competitor to *Pokémon Go*. But you can bet that a lot of meetings are going on right now concerning how to utilise AR across different gaming brands.

Other Apps

Perhaps we could see AR's popularity growing in non-gaming apps as well. Now that the mass market knows that their phones are capable of blending reality with cool digital elements, it seems likely that big companies will make their own AR apps to try to cash in.

You can certainly imagine a huge fast food chain like McDonalds considering some sort of AR app, perhaps something that encourages brand loyalty and allows you to check into your local Maccy Dees as if it was a Pokestop. The Happy Meal toys could become on-screen digital prizes. Offer codes could be earned by visiting more branches. And you don't need me to tell you the ways in which a location-based AR app could be used to tie in with their regular Monopoly-themed campaign.

It's also easy to imagine museums and other businesses that are built on visitor traffic investing heavily in AR now that they know how popular virtual interaction through handheld devices can be. There are already a few museums that have dabbled in AR as a means of bringing exhibitions to life (Search YouTube for 'augmented reality dinosaurs Ontario', and watch the top result for proof), and there are bound to be many more sprouting up over the next few years.

Niantic Labs already have an app called Field Trip, which alerts you and brings up local history information when you're near a significant landmark. Places of interest around the globe are bound to consider investing in location-based mobile enhancement like this in the wake of *Pokémon Go*'s success.

It'll Take Time And Big Dosh

As I mentioned earlier, it's a bit early right now to tell how big the rise of AR gaming and location-based apps is going to be in the wake of *Pokémon Go*'s huge launch week success. Discussions will be afoot in the offices of app developers, games companies and big corporations right now, as everyone wonders – as usual – how to make money from the latest craze.

But while we don't know for sure yet what will happen next in the AR apps market, there is one thing we do know: following in the footsteps of Niantic will not be a cheap or easy process.

"Making this stuff is not simple," Pete Hawley of the games company Red Robot Labs explained to the Rolling Stone website recently. "You can't just grab this location data and plug it in. It's time consuming, and it's expensive. It's not part of Apple's services, and it's not part of Unity [a very popular games engine]".

"Trying to pull this off at a reasonable cost is tough, so you're not going to see some little start-up just replicating what Niantic have done," Hawley explained, which makes it sound to me like we'll only being seeing big companies and famous brands buying into this market. This makes sense, considering that, without the brand recognition of Pokémon and the corporate support of Nintendo, who knows if an AR game about collecting monsters would have hit as big as *Pokémon Go* just did?

We'll have to wait and see, then. But I'll certainly be looking for a cut of the profits if any of the ideas I suggested in this article come to fruition. **mm**

Virgin Media Block Homeowners From House

Music For Geeks

Book your place now

Following the success of its first ever Music For Geeks night, the Cambridge-based Centre for Computing History is going to give it another go on August 13th.

Running from 7pm until midnight, the Music For Geeks event will be pretty much as you'd expect: live electronic and technology-related music inspired by both old and new technologies. Suffice to say it'll be a little bit of a different concert to your Lionel Richie or One Direction-type affair. In between acts, the audience can partake in some retro gaming, and you're free to bring your own drinks and nibbles along to keep the hunger pangs at bay. No nachos though, please (that's just our opinion – nachos are truly horrible).

Playing at the event are a three-piece experimental pop group from Cambridge, and a chap called gwEm, who has forged himself a niche in 8-bit music lasting over 15 years – during which time he's managed two hundred gigs. Blimey.

Spaces are limited, so you should register your interest right away over at **www.computinghistory.org.uk**. We'll be there with our glow sticks, rave whistles and air-horns.

Or possibly not.
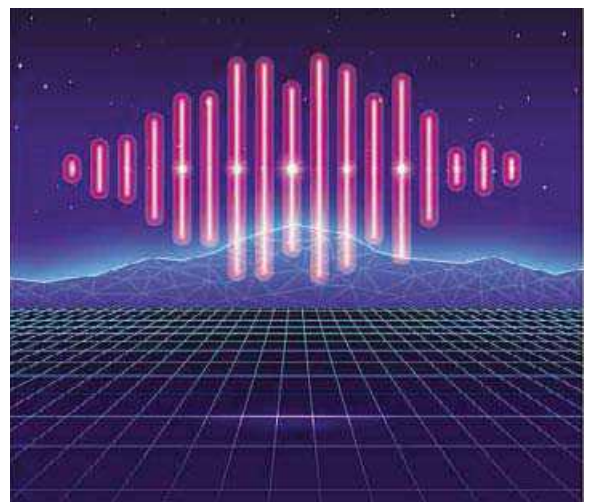
Bit silly, this

We've written in this very magazine about Virgin Media's super-fast Lightning broadband rollout, and the upheaval that it can cause to neighbourhoods. Well now a house in Bolton has been a victim of some over-zealous building works.

The house was reported in the *Manchester Evening News* as having been blocked off by roadworks surrounding the property. By all accounts, the homeowner arrived home from work to find that he couldn't access his own house and his wife and daughter were still inside. Virgin Media has since apologised, saying in a statement that the contractors would be spoken with, However, the adverse publicity the fencing has bought the firm is embarrassing for the company, to say the least.

Laying cables can be a messy business, but this takes the biscuit.

FUZE BASIC Now Free For Windows

Lovely

Fuze Technologies have enjoyed some success with both Fuze for Raspberry Pi and Fuze BASIC – and we're happy to pass on its news that Fuze Basic is now available for free for Windows.

That's a no-strings-attached free deal, with no purchase or registration required – and no restricted features. Along with Fuze BASIC you can also get lots of learning resources, tutorials, lesson plans and PDF project worksheets and this just sounds like a no-brainer deal for getting kids into coding.

For the uninitiated, Fuze BASIC will turn a Windows PC or Linux system into an accessible coding and electronics workstation and now that Fuze BASIC has an updated interface and more commands than ever, this seems as good a time as any to climb aboard. You don't need any prior programming experience and those worksheets and lessons we mentioned should be good enough to get anyone started.

Read more and download at **www.fuze.co.uk**.

▲ *One of the applications suggested by FUZE Technologies*

Trying to get a PC running faster is a pastime that can easily turn into an obsession. Once you've replaced the hard drive with an SSD, you've probably already completed the most effective step you can take towards boosting your computer's performance.

Even with this hardware in place, though, things can always be a little faster. Graphics cards can be pushed to run games at higher frame-rates, with more detail. Processors can be coaxed into providing more number-crunching power with a few tweaks. And everything can be made to run more efficiently, at cooler temperatures.

The gains you'll see with a lot of speed-up methods will often be slim, compared to a hard-drive-to-SSD upgrade, but as I know from my own experience of overclocking processors and graphics cards, they can mean the difference between a playable game and a slideshow.

If an SSD is out of the question financially, then getting your components and software running at their best is still going to be vital. So, whether you're using an SSD or not, hopefully there's something in this week's selection of tips and advice that will be useful to you.

Anthony

Meanwhile… On The Internet…

There has been a lot of talk in the last week or so about digital detoxing (**tinyurl.com/MMnet26a**), the idea that people are choosing to spend time away from the internet in order to reclaim some part of their life or psychological well-being that they feel our modern world has eroded (**tinyurl.com/MMnet26b**). While the idea is, frankly, anathema to us – you can imagine, considering our line of work, that any time away from a PC is a little weird – you have to say it's probably a step that a few more people should take from time-to-time (**tinyurl.com/MMnet26c**).

The wave of stories outlining just how horrible we've become as a nation because of the little devices in our midst (and, indeed, mitts) was created by Ofcom's *The Communication Market 2016* report (**tinyurl.com/MMnet26d**). Specifically, it outlined that while 75% of those surveyed "consider the web 'important' to their daily lives", 78% "agree it helps keep them up-to-date about current affairs" and 63% reckon it inspires them to try new things, as many as 1/3rd of UK adults have sought time away from the online world in the last year – with around 5% having abstained for a whole month (**tinyurl.com/MMnet26e**).

Among those excercising temperance, a third believed they became more productive during that time, while a quarter described the experience as "liberating" and said they "enjoyed life more". That was contrasted by the 15% who described feeling "lost" and the similar amount who felt "cut-off".

Of course, the internet is so woven into our lives these days that, given obsessive use of the internet's noted ability to actually change the way brains operate (**tinyurl.com/MMnet26f**) it's highly probable that anyone stepping away from it could feel all of those emotions at some point) – possibly simultaneously. That our feelings about it all seem so conflicted hints, however, that (as with many, many things) the problem is not with the thing itself, but with the way we use it (**tinyurl.com/MMnet26g**). Too much of anything is not good, right (**tinyurl.com/MMnet26h**)?

We sadly note the passing of Seymour Papert on July 31st, aged 88 (**tinyurl.com/MMnet26i**). A computer scientist, co-author of the Logo language (**tinyurl.com/MMnet26j**), writer of the seminal book, *Mindstorms* (**tinyurl.com/MMnet26l**), he was responsible for introducing thousands of children to programming via his 'Turtles' (**tinyurl.com/MMnet26k**). His theories led to a long collaboration with Lego, and eventually it's Mindstorms kits (**tinyurl.com/MMnet26m**). Sir, we salute you.

While the reviews for the much anticipated *Suicide Squad* have been less than stellar (**tinyurl.com/MMnet26n**), leading some fans to strike back at critics (**tinyurl.com/MMnet26o**), it's certainly managed to grab the attention of the internet. While endless pieces have dealt with the disappointment of fans, and the reaction of the movie's star to the negative reviews – including a somewhat embarrassing intervention from Cara Delavigne (**tinyurl.com/MMnet26p**) that alleged film critics don't like superhero movies (try telling that to our own Ryan Lambie: **tinyurl.com/MMnet26q**).

One person involved with the movie has secured more column inches that any other, though: Jared Leto, who's turn as the joker was one of the most anticipated aspects of the film. His on-screen performance may have underwhelmed (**tinyurl.com/MMnet26r**), his off-screen antics have kept gossip columns busy for quite a while now (**tinyurl.com/MMnet26s**).

So, when Leto turned up to the film's premier in a garishly apt, green Gucci coat (**tinyurl.com/MMnet26t**), keen watchers of the star quickly made a mental connection, and a meme was instantly born (**tinyurl.com/MMnet26u**). The three-picture sequence tells it's own story: Leto on front row of Gucci show, Leto in awe of green jacket, Leto wears green jacket... we were all happy that his childlike look of glee had turned into reality, right (**tinyurl.com/MMnet26v**)? Damn right!

Unfortunately, it was a meme too beautiful for this sick, sick world – and, much like the movie, the Suicide Squad star was only too happy to let reality destroy out happy little dream world (**tinyurl.com/MMnet26w**). Meanie.

The chances of us digitally detoxing, and spending less time on the internet, over the next couple of weeks are low. There are two reasons for this: firstly, we're weak and like the internet too much and secondly, it's Olympics time again. Yes, it really has been four years since the queen parachuted into East London (**tinyurl.com/MMnet26x**) and we were all super-proud to be British. Not that we aren't now, you understand, it just feels like there's a little less pride-inducing stuff going around at the moment. It may be just us, but there you go.

Of course, if you really want something to be proud of, the BBC usually provides it. We're sure it's Olympic coverage will be top-notch once again (**tinyurl.com/MMnet26y**), and it even plans to show some events in 360° video via its 360 Sport app, and it's Taster website (**tinyurl.com/MMnet26z**). Nice.

.AVWhy..?

Oliver Stone has pretty much forged a career out of paranoia, so when he announced that he would be tackling the story of Edward Snowden nobody really batted an eyelid. The flim's first trailer appeared a few months back, showcasing Joseph Gordon-Levitt's turn as the NSA whistleblower, and it was interesting Stone fayre (**tinyurl.com/MMnet26aa**). However, his latest promo is something a little more out of the ordinary; a faux-serious (or perhaps faux comedy, we're really not sure) public service announcement that reminds people they're being tracked by their smartphones, and – oh, yeah – that they should turn them off when watching a movie (**tinyurl.com/MMnet26bb**). Weird.

QUICK BITS… Microsoft has rolled out its free Anniversary Update for Windows 10 users

Caption Competition

"I have to dress like this, my browser is in stealth mode."

Two weeks ago we asked you to caption this image. Here's the best of a bumper selection:

- **Dwynnehugh:** "Oh for the days when you only needed two sights to fire your rifle."
- **doctoryorkie:** "Don't mention the World of Warcraft. I mentioned it once but I think I got away with it."
- **gregb49:** "Jake was disappointed by his WhatsApp test of his new Poundshop 'youcantseeme' suit."
- **Mad Malc is back:** "Having taken his rifle off him for 'his own protection', he decided to get his own back on the H.S.E. by making it impossible for them to carry out a D.S.E. risk assessment."
- **BJM:** "Experienced new applicant takes Amazon's delivery driver test."
- **BullStuff:** "Damned MOD budget cuts! Why can't I have a desk?"
- **pesukarhu:** "The new CoD VR really means business!"
- **BullStuff:** "Look, Sir, why do I have to wear camouflage when I am piloting an armed drone from an office 8,000 miles away?"
- **pesukarhu:** "No, I said "Apply SOLDER to the laptop motherboard, not apply SOLDIER!"
- **Brian Jones:** "What do you mean the drone was on loan to Amazon UK? I've just nuked the middle east."

Thanks to everyone who made us giggle, and those that didn't too… but this week's winner is **Thomas Turnbull with** "I have to dress like this my browser is in stealth mode."

If you have a caption for picture below, head to the 'Other Stuff' section of our forum (**forum.micromart.co.uk**), or email us via **editorial@micromart.co.uk**, remembering to add the issue number to the email subject line.

HP Won't Honour £2 Laptop Deal

Did anyone really think it would?

Eagle-eyed shoppers visiting HP's UK website recently were met with the opportunity to buy premium-end laptops for less than £2. The surprisingly attractive deal was all down to an error, which must have had a few staffers sweating for a while.

Understandably, that kind bargain was snapped up by many – but it's also equally understandable that HP is now backtracking. A statement from the company said buyers would be refunded and apologised for the error. If anyone thought that they would get a laptop for £2, they're going to be disappointed.

Domain Sells For $135m

Auction sees big value placed on .web

Nu Dot Co is now the owner of rights to use the .web domain suffix, allowing it to offer companies the opportunity to own a .web domain. The firm paid $135m for that right, a huge amount of money that even outbid Google, which was involved in the bidding process for this one.

The process of selling the suffix actually started back in 2012, so it's taken a long time to reach this point. However, for Nu Dot Co – a company that, frankly, nobody seems to know an awful lot about – the appeal was worth hanging in there with some big spenders. It's obvious why; you can imagine that there will be plenty of firms keen on a .web suffix.

Apple Sells Its Billionth iPhone

We're not at all surprised

It may have taken nine years, but Apple has now sold its billionth iPhone. Despite some rather less-then-thrilling financial results, Tim Cook did have that marvellous news to tell his employees in a staff meeting, and they are quite right to celebrate what has undoubtedly been one of the company's greatest success stories.

We'll let Tim say a few words: "The iPhone has become one of the most important, world-changing and successful products in history. It's become more than a constant companion. The iPhone is truly an essential part of our daily life and enables much of what we do throughout the day." Well hang on, Tim. Other phones are available, you know?

In truth, it would be hard (and incorrect) to deny that Apple's smartphone has taken the mobile market by the scruff of the neck and helped to make it what it is today. You don't have to like them – heck, you can even loudly shout at them if that's your thing – but the simple fact is that the iPhone is here to stay.

No Man's Sky Leaked

We don't want to know

If a certain Redditor is to be believed, someone has got their hands on a copy of *No Man's Sky* before its release (due August 12th for the PC). Its publisher, Hello Games has been notably secretive about the game before it lands, in a bid to heighten already-fevered anticipation of the title. However, a Reddit user claims to have paid over $1,000 for an early copy of the game, backing up his claim with a bunch of videos showing the game off. No doubt it's all a bit annoying for anyone who wanted to know as little as possible about it.

On behalf of its creators, Hello's Sean Murray, took to Twitter to offer this advice: "We've spent years filling *No Man's Sky* with surprises. You've spent years waiting. Please don't spoil it for yourself." Quite right, Mr Murray.

Are claims that the game can be completed in 30 hours correct? Well, the game should be out by now so you might already have experienced the vast universe for yourselves. Needless to say that we'll be seeing you in cyberspace, people.

QUICK BITS... Tesla has bought solar panel company SolarCity for around £2bn

Australia On The Move

Sat Nav difference leads to co-ordinates move

Various media reports have focused on news that Australia – yes, the entire country – is moving its longitude and latitude coordinates because global navigation satellite systems differ from local coordinates by over a metre. With driverless cars on the not-too-distant horizon the need for location data to be as accurate as possible is obvious, so this is actually a perfectly sensible idea.

Did you know that Australia moves about 7cm north every year because of the Earth's tectonic movements? No, neither did we, but it's because of this that the coordinates differ over time. So, on January 1st next year (according to the BBC) Australia's local co-ordinates will be altered north by 1.8m, allowing the country's local and global coordinates to be in line on 2020.

Are you still with us?

"Donkey Whisperer" Uses Tech To Analyse Sounds

We have no words... But we love this story

A so-called "donkey whisperer", hailing from West Yorkshire, recently teamed up with Merlin Events to offer donkey rides with a difference in London. The Real Donkeys' experience, which took place in Jubilee Gardens, let kids hear the donkeys' sounds being translated into English thanks to technology that analysed the unique sounds, frequencies and vibrations of each "ee-aw", before translating it into an English phrase.

The owner of Real Donkeys said: "We work very closely with them... and pick up on their mannerisms, their emotions, what they're thinking basically."

The mind boggles as to what kids heard from the donkeys. We imagine that the phrases coming from the animals' mouths were along the lines of "Please, can I have my dignity back", "Can I have a rest?" and "If you kick me one more time...", though possibly not. As this was a limited time event, we may never know.

Kaspersky Backtracks On Sexist Ad

Apology from security outfit

Sigh. The ugly face of sexism appeared over at Kaspersky in the form of a pop-up advert that was discovered – and then widely derided – on social media.

The ad, a cartoon depicting women lining up next to a chap sitting on a bench working on a computer, had the caption: "Want to be the man? Want to show the ladies your smarts? Bring them to the Cybersecurity world and get rewarded."

Good grief. The very idea that this kind of thing can exist in this day and age seems utterly ludicrous, but then we do live in a world where Donald Trump is very much in the running to become the next President of the United States…

Anyway, Kaspersky very quickly apologised and has also removed the advert, so it won't be popping up again. How on earth it got out there in the first place is the big worry, though.

iPlayer Loophole Closing

TV licence required by all

The government is closing a loophole regarding the BBC iPlayer and TV licences. Previously, people watching catch-up television on the Beeb's service didn't need to have a TV licence to do so, unlike people who used the service to watch live TV.

This meant that frugal people could save themselves some cash by only watching BBC content on catch-up, but from September 1st that's all changing. The government is introducing a piece of legislation meaning that everyone will have to pay to watch BBC programmes, whether they do so via live TV or via catch-up. The BBC reckoned that the flaw in the law was costing it somewhere in the region of £150m in revenue per year so, if you think that the BBC is worth investing in then, this is ultimately a good thing.

If you are affected by this, look at it this way: it was a good thing while it lasted, eh?

Buffalo Airstation WBMR-300HPD Modem Router

A highly configurable router with an open-source firmware

Buffalo is more recognised for its NAS and external hard drive solutions than its routers, but the company has an interesting selection available, including the Buffalo Airstation WBMR-300HPD modem router.

It has a number of worthy features to its name. For one, it's an ADSL2+ modem, router, access point and extender, with Wireless-N standards for connection up to 300Mbps and a pair of high-gain 5dBi antennas, all packed into a relatively slim 165 x 158 x 35mm glossy white case.

For a start, it comes with the open-source DD-WRT NXT firmware pre-installed – a Linux-based firmware that offers support for Open VPN, Kai Network, WDS, RADIUS and root level SSH device management. You'll also find DNS caching, QoS, VLAN and 128-bit WEP security.

The design of the WBMR-300HPD is fairly standard, with a large WPS button on the front, accompanied by a row of four LEDs indicating power, WLAN, internet access and whether the device is in router mode or not. It also has two screw mounts for the antennas to fit to, and the rear of the router houses four LAN ports, with one for WAN, a DSL port, power button and power port.

There are slots in one of the sides for wall mounting, and the router comes with a easy clip-on stand for vertical position. The side with all the mount slots also has four rubber feet if you prefer to have the router horizontal.

The router is certainly easy to set up via the web browser interface. From there you can configure the settings or set the router up as a true modem router, access point or extender. Thankfully, Buffalo made this interface easy on the eye, without the need to dig too deeply into various sections and sub-sections before you find what it is you're after.

What you get here is good enough for most users, but we do feel that there's a lot missing from the WBMR-300HPD that comes as standard on most routers, even ones supplied by ISs.

One of the glaring design omissions is the lack of gigabit Ethernet across the available LAN and WAN ports; in this case, you'll only get 100Mbps. While only having access to a 100Mbps backbone isn't going to affect a lot of users, it will impact on the future growth of your home network. It also lacks a USB port on the router, leaving you to rely on either a USB to network adapter or some other form of sharing. Considering the router is designed by a company that also produces NAS devices with USB ports, this seems like an odd thing to leave out.

Another aspect that's left out is dual-band connectivity. While the 2.4GHz band is adequate, it's a rapidly consumed band that's easily swamped and negatively by other factors. Either way, it's yet another element that's missing from an otherwise good router.

The Buffalo Airstation WBMR-300HPD isn't too bad a router, but there are just too many features that even the most basic units offer that are missing here. Its highly configurable nature is to be applauded, but we feel there's not enough to tempt a user beyond their ISP-supplied router.
mm David Hayward

Although with good elements, there's too much missing

micro mart

6 Quality
5 Value
6 Overall

PC Specialist Hydra 1000

To be this cool takes lots of system building skill and some distilled water

P C Specialist, certainly no stranger to the pages of Micro Mart, has been designing and building PCs for over 14 years now and has a decent collection of awards under its belt.

The Hydra 1000 is a well-specified, all-round PC to test. A Corsair Spec-03 Gaming Case houses an Intel Core i5-6600K clocked at 4GHz, with 16GB HyperX Fury DDR4 2133MHz memory, a 240GB Kingston UV400 SSD with Windows 10 64-bit, and a further 1TB Western Digital Blue secondary hard drive.

The CPU is cooled by a Corsair H80i v2 Hydro Series liquid AIO unit. The H80i v2 is an excellent addition to the build, with a dual 120mm fan either side of the large aluminium radiator and a large copper plate to draw the CPU heat away. You also get Corsair's Link software, which allows you to view the current system temperatures and create profiles based on Performance, Balanced and Quiet – not that the H80i v2 is noisy at all.

Graphics come courtesy of a new Palit Dual GTX-1060, with a 1506MHz GPU clock and 1709MHz boost, 6GB of GDDR5 memory with a clock speed of 2002MHz, 1280 CUDA cores and connectivity consisting of a single HDMI port, three DisplayPorts and a single DVI.

The use of the GTX-1060 is an interesting choice here; it's new and so far untested in gaming

⌃ The PC Specialist Hydra 1000, with its Corsair Spec-03 case and red LED setup

⌃ The driving force behind the cooling, the Corsair H80i v2 Hydro Series Liquid CPU Cooler

circles, using Nvidia's new GP106 GPU. It's a little more expensive than the rival Radeon RX-480, but it's also slightly more powerful, and for those who are still on the last nine-series Nvidia cards, the 1060 is an improvement on the 980, but only just.

Together with the above, the Hydra 1000 also features an Asus Z170-P motherboard, with support for SLI and an M.2 connector. There's a DVD drive present, and the system comes

with a Cooler Master Storm Devastator II keyboard and mouse kit.

In terms of performance, the Hydra 1000 managed a very respectable overall score of 14,143 in 3DMark 11, putting it well above the recommended spec for VR and toward the realm of 4K gaming. The ATTO benchmark was good too, with the Kingston UV400 managing an 8192KB test score of 445MB/s write and 517MB/s read. It performed well in the smaller

4KB test too, with 260MB/s write and 212MB/s read.

The Hydra 1000 from PC Specialist is an excellent choice for those wanting a high-quality all-round PC, with the benefits that liquid cooling offers. There's plenty of scope for upgrading the system and for further overclocking, thanks to the H80i v2. We even like the red LED effects from the front 120mm fan and the 600mm LED strip laid out on the inner rim of the windowed panel.

Surprisingly, all this comes at the reasonable price of £1,000, which also includes a three-year warranty, one-month return and collect, one-year parts and three-years labour.

In short, the PC Specialist Hydra 1000 is an excellent PC. It's superbly built, well designed and performs magnificently. If you're up for a new system and you fancy one that's liquid cooled, then the Hydra 1000 is certainly one to consider.
mm David Hayward

Excellently built, with some interesting components

EDITOR'S CHOICE
micro mart

micro mart
9 Quality
8 Value
9 Overall

HP DeskJet 3720

HP launches the world's smallest all-in-one printer (possibly)

HP has been making DeskJet printers for the best part of 30 years, but it seems it's not done yet. Before I get to its latest entry, though, let's talk about why this device exists and why, at less than £60, it's so cheap. The critical word here is 'consumables'. Rationally, all of HP's printers are really a means to a profitable end from a commercial perspective.

Realising that users feeling gouged for consumables is a major barrier to selling more printers and consumables, HP devised 'HP Instant Ink', a subscription system starting at just £1.99 per month. With it active, the printer automatically orders new supplies when they run low. For the £1.99 you get 50 pages a month and £3.49 gets you 100 pages, and £7.99 for up to 300 pages. If you don't use those pages, they roll over to the next month, thankfully.

This service started on its higher-end professional series printers, and now it's available on its entry-level devices, like the new DeskJet 3720.

This is the perfect printer for a student or child who has limited space, because despite having a remarkably small footprint, it does almost everything. By that I mean that it prints, obviously, but it also scans, copies and is internet connected via wi-fi.

What strikes you first, other than the tiny scale, is the dayglow cyan-and-white colouring (or 'Electric Blue', as HP refers to the highlight colour).

Once you've installed the two cartridges (black and tri-colour) and connected it using either USB or the built-in 2.4GHz wi-fi, you're free to print from your mobile devices or PC, or scan back to them. Printing resolution is a crisp 4800 x 1200dpi, and it can scan up to 1200dpi (600dpi optical) in 24-bit full colour.

Print stock is loaded on a deployable ramp on the rear, which takes a maximum of 60 pages, and there's a corresponding catch tray at the front for when they emerge. How long it takes for them to get there entirely depends on the quality and coverage you expect. ISO speeds are 7.5ppm for black and 5.5ppm for colour.

A full A4 test print at best quality took six minutes and 50 seconds, with admittedly excellent results. While not exceptionally quick, this isn't made for high volume.

If I have a problem with this design, it's the implementation

Product Features
- Instant Ink - three-month free trial.
- Wi-fi and Apple AirPrint.
- Colour print / copy / scan.
- Single-sided printing.
- The world's smallest all-in-one printer (not really).

of the scanner, cleverly hidden under the white bar.

Material to be scanned is offered at the front, at which point pinch rollers grab it automatically. With no physical support for the document or any adjustable guides, the chance of getting the paper perfectly square is practically nil. Out of ten attempts I got one that was square and plenty of odd angles. If you intend to do lots of scanning I'd invest in something bigger, ideally with an auto-feeder.

My other complaint is that HP does like to bug its customers excessively. After the driver was installed on my PC, every time I went to print, a web page popped up commending me for installing a 'New Genuine HP Cartridge' and wanting to whisk me away to buy some more!

Eventually that disappeared, and HP found other excuses to fire up Internet Explorer – a browser that I don't use, that isn't secure and isn't my default.

It's also pushing hard its new HP Social Media Snapshot app and includes a pack of the Snapshot stickers for you to use. These are 5" x 4" self-adhesive sheets designed to let you print from Instagram, Facebook and Flickr and relive the Polaroid era, yet again.

Those irritations aside, the value of this printer comes down to ink and how much it costs to run. Replacement official HP 304 carts cost £10 each, and I used the standard colour one up entirely in six full coverage pages. It does make XL versions, but these are £19.99 and £20.99 respectively for black and colour, with a 300-page yield on both with 5% coverage, or roughly three times that of the standard cartridges.

The hint, if you didn't get it, is to pay the subscription where 300 pages on either black or colour will cost you £7.99 a month, or less if you don't print as often.

HP is promoting the DeskJet 3720 as 'The world's smallest all-in-one printer', and it is jolly small. However, as a number of people have pointed out it isn't, and to be fully accurate, it isn't even the smallest all-in-one that even HP makes.

As a design, the efforts HP made to make it this small have compromised some aspects, especially the scanning. Yet for a small volume printer that you don't even need to wire up to your device to work, it's ingenious in many respects.
mm Mark Pickavance

A tiny all-in-one that begs for a monthly ink subscription

micro mart

Quality **7**

Value **8**

Overall **7**

Dell Vostro 3900 Mini Tower

Dell offers a flexible mini tower design to interest business customers

There is something delightfully retro about the Dell Vostro 3900 Mini Tower. The designers placed the PSU at the top of the case where they all once resided, and a mini bay on the front for a long gone floppy drive.

But being realistic, business customers want the very height of 2007 fashion in their computers, because to them that spells 'reliability' and not 'obsolescence'. In many respects that's exactly what the Vostro 3900 delivers.

No Skylake technology hidden in here! Instead a Haswell Core-i5 4460, circa Q2 2014 and an H81 motherboard to provide the LGA 1150 socket that CPU requires.

Being a feisty quad-core processor clocked at 3.2GHz, this is about as 'out there' as the Vostro 3900 gets, because everything else Dell put in it appears to have the intention of holding it back, rather than speeding it up.

You get 4GB of RAM in a single PC3-12800 (1600MHz) DIMM, avoiding any of that helpful dual-channel nonsense. You can add another to the second DIMM socket, a move that is probably worth the roughly £12 a 4GB DIMM would set you back from an online retailer. Dell doesn't offer this as customisation, at any price.

Another performance anchor lobbed overboard is a Toshiba 500GB SATA hard drive, which isn't cushioned and makes the case rattle. It also had a SATA DVD-R installed and a 300W PSU, should either of those things be critical to you.

In terms of potential hardware upgrades, this is one of the least proprietary systems I've ever seen from Dell. The PSU is the normal size, the motherboard has a micro-ATX layout, and internally there is an unoccupied 3.5" drive tray. There's also a single 5.25" external bay unused, should you want another optical drive or a bay-mounted accessory.

For those wanting to add a video card, this is possible with the single PCIe x16 slot, and for less demanding cards at hand, there are also two x1 slots and a single legacy PCI.

The H81 chipset only has two 6Gbps SATA ports and two more 3Gbps bring up the complement. And another limitation of that chip is that it only provides two USB 3.0 ports, both being placed on the rear of the machine.

That makes the placement of a recess on the case roof for external drives even more peculiar, because when placed in it, a drive can't reasonably connect to the rear USB 3.0 ports, and even the front facing USB 2.0 ones aren't near enough for most external drive designs.

The video output options are VGA or HDMI, but no DVI or DisplayPort from the integrated Intel HD 4600 GPU.

In terms of software, Dell provided the machine with Windows 7 Pro pre-installed, as the majority of IT departments would want. You get a free upgrade to Windows 10 (until the end of July), though you'll be doing that update yourself.

In addition to Windows, Dell unfortunately couldn't resist spamming it with the 30-day Office trial and something equally useless from McAfee. That gives the IT department plenty of work to do in prepping this machine for deployment, if only to clean off the unwanted junk.
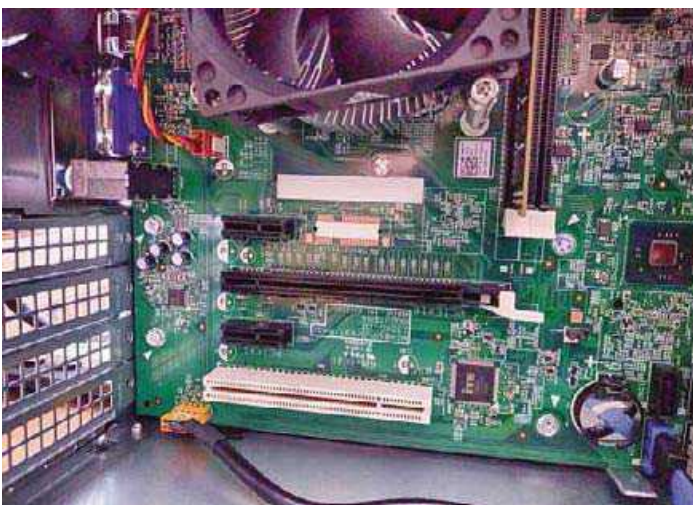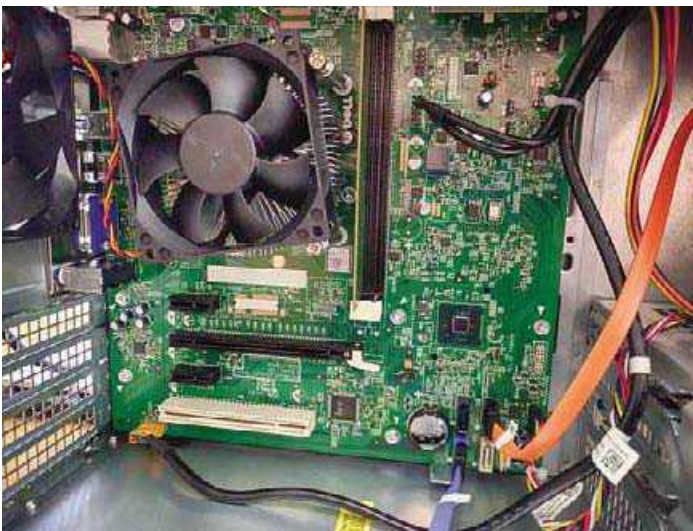
In terms of the design, the only real mistakes I noticed were that the power button is far too low for a floor-standing computer, and there are no air filters in the case.

Along with the machine you get a wired mouse and keyboard, but a monitor is not provided. Dell will offer you a vast range of monitors starting with a 17" or 19" models for £89, going up though many different screens to a Ultrasharp 24" U2413 for £342.

Initially, given that it isn't exactly cutting edge, I was inclined to think the Vostro 3900 was on the expensive side. A quick look at what Core-i5 4460 costs at retail did paint things in a subtly different light, because that chip is around £170 inc. VAT from most retailers.

With VAT added to the base cost, the CPU is half the value of the system, and I'd be hard pressed to assemble a machine of this specification for less than £350 including VAT.

By spending just a small amount more on RAM and a small SSD, this could be turned into a very admirable performer for general office use and even more demanding tasks.

The only major mistake that Dell made was to prune down the specification more than was truly necessary, probably to achieve the headline price. And a PC made for a price is critically what the Vostro 3900 is deep down.

If the price is right for your business, then there's very little wrong with it, unless you're looking to do more with your computers than run Office and browse the web.
mm Mark Pickavance

A powerful office PC at a bargain basement price

micro mart

7 Quality
8 Value
7 Overall

Lexar JumpDrive S45 64GB USB 3.0 Flash Drive

Lexar protects the easily broken parts of laptops with its tiny USB drives
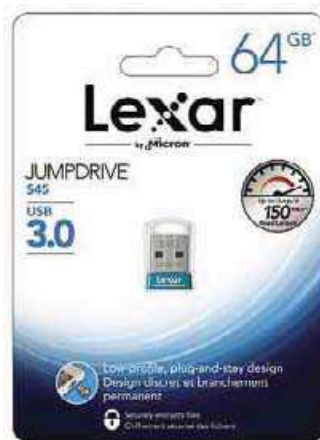
I've seen some nasty accidents with USB keys and laptops, especially when their designers put ports along the hinged edge. The forces put on a drive and port through the potent power of the lever is often more than either can stand, should the machine be inadvertently twisted in the wrong direction.

At best, the drive is broken and inaccessible and, at worst, the port damage is translated internally on the machine's motherboard, and that can be fatal.

The Lexar S45 Jumpdrive aims to avoid those calamities for those who like to leave USB keys in position, by making the drive so small that only a tiny portion of it sticks out when it's inserted.

This isn't exactly a radically new idea. Samsung has its 'MicroFit', SanDisk its 'Ultra Fit' and Patriot its 'Tab Series'. I've also seen Bluetooth adapters like this for a while, but this is the first time

> ## " Unless you have an aversion to the small, the S45 is a useful item "

that I've reviewed flash storage compressed down to these amazingly small levels.

The review version was a 64GB drive, though the 128GB model is no larger physically. All that differentiates them from the outside is the colour of the protruding end and the capacity number stamped on the blade. When the drive is being accessed, a small LED helpfully makes the visible part of the drive flash.

According to Lexar, all sizes promise 150MB/s read speeds, but the 16GB model is only rated for 20MB/s writes, and this improves to 30MB/s on the 32GB and 45MB/s on both the 64GB and 128GB options.

However, in my testing, the read speed was a little shy of predicted at 134MB/s, but the write performance was substantially better at 116MB/s. I tested the S45 on two entirely different systems, one Intel and one AMD, with much the same results.

Lexar said that it's quick at writing small files, though I wasn't anticipating it being this good given the quoted performance on the packaging.

The drive comes formatted in exFAT and has a copy of EncryptStick Lite software, an advanced security solution with FBI-annoying 256-bit AES encryption.

In terms of pricing, the 16GB S45 is just £7.99, whereas the 32GB is only about £4 more. Moving up to the 64GB version costs £18.99, and the 128GB model is a very pocketable £28.99.

Cranking those numbers, the drives become better value at greater capacities, with the 128GB drive being less than half the price per gigabyte compared with the 16GB unit.

If you don't need that much space, the 64GB S45 is probably the sweet spot, because it has the same write speed, but it costs a good bit less than the 128GB.

Unless you have an aversion to the small, the S45 is a useful item to have, especially if you own a laptop.

mm Mark Pickavance

A small, neat and rapid USB storage solution

Features
- Low-profile, plug-and-stay design.
- Stores and transfers content quickly with USB 3.0 performance (up to 150MB/s read and 45MB/s write).
- Securely protects files using EncryptStick Lite software, an advanced security solution with 256-bit AES encryption.
- Compatible with PC and Apple Mac systems.
- Backwards compatible with USB 2.0 devices.
- Three-year limited warranty.

micro mart

8 Quality
8 Value
8 Overall

Zombie Night Terror

Control the undead in this fleshy feast of a game

⌃ *With careful planning, you can turn all the humans into zombies*

⌃ *Be warned, some humans are well armed and don't like being eaten*

Developer NoClip has taken a classic *Lemmings*-like concept and introduced it to the zombie culture in a gory, blood-soaked 2D strategy game. The result is *Zombie Night Terror* – and it all works rather well.

Set in a semi-monochromatic, film-noir, 16-bit pixel art world, you're the mastermind behind this zombie invasion, and your goal is simple: try to infect as many people as possible. But doing so is quite tricky.

You have a set number of zombie DNA points in which to infect the on-screen non-zombie population. The more people you infect, the more DNA points you'll have available. The DNA points you gain will unlock zombie mutations, which can then be used to direct, explode or speed up, or leap to otherwise unreachable areas of the scrolling level.

Each zombie used up is one less in your horde, so you'll need to feed off the humans who are scattered throughout the level. Some humans are easily eaten, cowering in a corner while your zombies approach and begin to feed on them. Others carry an assortment of weapons, which can quickly decimate the number of zombies you

> ## 66 The environment can be as deadly to your zombies as the humans 99

have under your control. Too much damage from a well-armed human and you're reduced to a just a few zombies, who won't be able to complete the level or the challenge.

The trick, therefore, is to carefully plan the march of your zombie army, taking in as many human hot-spots as possible, to increase your numbers and DNA points, while still being able to reach the end-of-the-level goals. The

further you advance, the more special abilities you'll unlock, until you're able to chain certain abilities and create the ultimate zombie horde.

The film-noir look works well, especially when mixed with the stark red of your victim's blood or the luminous green of zombie DNA. Later levels can get tricky, though, and you'll find yourself restarting more often than not, due to a miscalculation or a particularly nasty human.

The environment can also be as deadly to your zombies as the humans, though. A drop that's too high will kill off a bunched together group of zombies, or if you don't get them off the train tracks quick enough, they'll be mowed down, reducing your army to just one or two stragglers.

While *Zombie Night Terror* is an addictive and fun lurch through the eyes of a zombie horde, it can become frustrating as your supply of DNA is soon limited and a badly timed applied ability goes horribly wrong. If you're over halfway through a challenging level when that happens, it's back to the start again. While that's part of the game, it can leave you feeling a little annoyed at the mechanics. But perseverance is key, and you'll soon learn to take advantage of zooming in and out of the action to pinpoint and target individual zombies or areas.

For a mere £9.99, *Zombie Night Terror* is an interesting, challenging and fun game to play.
mm David Hayward

A cracking Lemmings-like game, with a gruesome twist

micro mart

8 Quality
9 Value
8 Overall

While curved monitors aren't on everyone's desks, yet, they're slowly becoming more popular with gamers and those who want more screen for their money.

We've been looking at a collection of monitors of varying sizes. Could one of them be your next upgrade?

Curved Monitors

BenQ XR3501

DETAILS
- Price: £650
- Manufacturer: BenQ
- Website: goo.gl/8QB5Nz
- Requirements: HDMI or DisplayPort GPU, AMD GPU for FreeSync use

⌃ *It's certainly large enough for gaming*

⌃ *The curve works well, but the image quality isn't the best we've seen*

We looked at the BenQ XR3501 recently on its own, and while it's good, how does it fare against other curved monitors available at the moment?

First off, the BenQ is at the extreme end of the scale when it comes to curved screens. The huge 35" curved display is, of course, the dominating feature here, with the 2560 x 1080 resolution, 144HZ refresh rate 8-bit AMVA panel offering a field of vision, due to the 2000R curve, equal to that of an IMAX theatre screen. This totally immersive view is kept clear and responsive thanks to a 21:9 aspect ratio, 178° viewing angles and 4ms response time.

You also get the usual array of BenQ Eye Care features. These include low blue light levels; a Black eQualiser mode to improve darker scenes in-game without saturating and over-exposing the surrounding areas; a 20-level colour vibrance setting; and the BenQ Senseye feature, which can automatically adjust the display depending on the environmental light levels.

The design of the XR3501 is certainly good. The surrounding bezel isn't too thick and is made from a matte-black plastic, eliminating the reflection and smudging that can occur with a glossy finish. The stand is good too and offers a basic tilt to alter the viewing angle. Thankfully, the screen itself is mounted quite high on the stand, so there's good clearance, and the display is already roughly at eye level.

Connectivity consists of a pair of HDMI ports, a DisplayPort, a mini DisplayPort, line-in, line-out and a headphone port. Built into the XR3501 is the AMD Freesync technology, which pairs any AMD GPU nicely with the monitor to eliminate screen tearing and other signs of lag. You'll need an appropriate AMD GPU, of course, but the effect it has on gaming is well documented elsewhere and is surprisingly good.

The monitor is weighty, though, and a little awkward to manhandle into position. It weighs around 11.5kg, so if you've got a dodgy back, you may want to employ another pair of hands to help to get it into place.

The quality of the image is good, though, but when put next to some of the other examples we have in this group, the BenQ doesn't come out quite as well. The screen is quite dark, even when the contrast and brightness levels are increased, so the colours appear a little muted. Next to the Samsung LC27F591FDUXEN, the XR3501 isn't anywhere near as clear or as sharp.

In terms of price, the BenQ XR3501 comes in at around £600, which certainly isn't cheap. It is, though, a good monitor, but it's a little too expensive considering what other monitors can be bought for that amount of money.

micro mart

7 Quality

6 Value

7 Overall

Samsung LC27F591FDUXEN

The Samsung LC27F591FDUXEN is a 27" monitor with a screen curvature of 1800R, a maximum resolution of 1920 x 1080, a response time of 4ms and a 3000:1 standard contrast ratio from a VA panel. In addition to that, Samsung has included the Mega ∞ DCR feature, which dramatically improves the visual quality of the blacks and whites on-screen. Although Mega ∞ DCR may well be marketing speak, it's a feature that actually does a pretty good job of increasing the quality of the output.

Connectivity is okay, with HDMI, DisplayPort and VGA. And alongside the available inputs, you'll also find a couple of audio ports and power. There's also a joystick-type control at the rear right-hand corner of the screen, which will activate the OSD and allow you to navigate through the available menus.

The design of the LC27F591FDUXEN is really quite stylish. With a solid white chassis and a super-thin metallic bezel, it certainly looks good on the desk. It has a circular metallic-looking plastic base that's connected to the monitor via a thin stand. This doesn't offer much in the way of height adjustment, but you can tilt the screen to around 20°.

↖ *More than just a very long name*

↖ *It looks great, and the screen quality is superb*

As for the quality of the display, Samsung has done an excellent job here. The LC27F591FDUXEN offers a superior level of colour, crisp lines, Samsung MagicBright, Flicker-free technology and an easy eye mode, and there are a lot more quality-enhancing features than most monitors offer. Gaming, movies and even work is a pleasure to view; you would be forgiven for not wanting to return to your regular monitor after an hour or two of using this model.

What's more (and something that's quite unique among monitors), the AMD FreeSync technology is available over the HDMI port, not just the DisplayPort. This gives gamers with the right hardware a better choice of how to hook up their screen; not everyone has or wants to purchase an additional DisplayPort cable.

Compared to the BenQ XR3501, this Samsung monitor really stands out. While it's not anywhere near as big or, thankfully, as cumbersome, the output quality is significantly better.

We were quite impressed with the Samsung LC27F591FDUXEN. It looks great, has a fantastic display and is reasonably priced at around £240. In fact, for that price you could have dual curved screens, and it would still be cheaper than the BenQ or the Philips model in this group.

micro mart
9 Quality
9 Value
9 Overall

Philips 34" Curved UltraWide LCD Monitor

The Philips Curved UltraWide LCD (code number: BDM3490UC/00) is one of the Brilliance range of high-performance screens. It has a 34.1" AH-IPS LCD screen, a 3800mm curvature and an aspect ratio of 21:9.

The resolution offered here is 3440 x 1440 at 60Hz, with a Smart Response time of 5ms, along with a standard contrast ratio of 1000:1 and a smart/dynamic contrast ratio of 50,000,000:1. Since it's an IPS panel, it offers good viewing angles, with 172° on the horizontal and 178° on the vertical.

It has three HDMI ports, two of which are 1.4 (with one being MHL capable) and the third supporting HDMI 2.0. There's also a DisplayPort, audio in, a headphone socket and a four-port USB 3.0 hub.

The design of the monitor is excellent, with a white almost Apple-like rear panel to the screen and an impossibly thin 3mm bezel surrounding the viewable panel. This alone makes the screen size feel bigger than it already is and is a feature we'd wish other monitor manufacturers would employ regularly.

The image quality is very good, with excellent colour depth and clarity, as nearly as good as the Samsung model. The brightness levels were a little high for our personal tastes out of the box, but it's

⌃ The Philips 34" curved monitor offers great image quality

⌃ Connectivity is good, but it's an extraordinarily expensive monitor

easily rectified. Perhaps a low blue-light option wouldn't go amiss here.

Nevertheless, the image quality is great, and the gradual curve draws your eyes towards the centre of the screen, with the visible curvature creating a surround effect. There's more than enough screen space to split the screen in two or even three if you want, with a couple of decent 1720 x 1440 displays within a single monitor.

As you would expect, the Philips 34" Curved UltraWide monitor comes at a higher than average price – £680 to be exact. There's no denying that's a lot of money to fork out on a single screen. And this screen is a monster of a monitor to have sat on your desk. While that's not necessarily a bad thing, it does tend to take over the average desk and swamp everything else around it.

The image quality is higher than some of the other monitors here, but perhaps not quite as detailed as the Samsung. If you're willing to forgive the smaller screen size and you don't need the extra connectivity or a USB 3.0 four-port hub, then we think you're still better off with a pair of the Samsung monitors instead of a single, large Philips display.

micro mart

8 Quality

6 Value

7 Overall

Dell SE2716H

DETAILS
- Price: £265
- Manufacturer: Dell
- Website: goo.gl/Lp3fPT
- Requirements: HDMI and VGA graphics card

▲ *The Dell SE2716H is well built, but the image quality is lacking*

◄ *It's reasonably priced, but doesn't stand up against the competition*

T he Dell SE2716H was launched toward the end of last year, in response to the likes of Samsung and other companies releasing a selection of business-class curved screens.

Not wanting to be outdone or to leave a gap in the company's product line, Dell's SE2716H is designed for the home and home office range. But does it have what it takes to beat the other monitors this week?

The SE2716H is a 27" VA panel with a resolution of 1920 x 1080 and curvature of 1800R. It has a dynamic contrast ratio of 8,000,000:1, a response time of 6ms and good viewing angles of 178° on both the vertical and horizontal.

Connectivity consists of a pair of HDMI ports (one of which is MHL enabled) and a VGA port. You also get audio-in, a headphone port and a pair of surprisingly decent 9W speakers.

The build quality is good throughout, and the monitor does look reasonably stylish. The small curved plate-like stand fits to a squat monitor arm, with a large cable tidy hole. The thin bezel is certainly a good touch, and as with the other thin bezels we've seen, it help makes the screen size feel bigger than it actually is.

In our tests, the image quality, however, wasn't as good as the physical attributes. While the image was reasonably sharp, the colours felt very drab and lacking in depth. Although the image was quite bright, there was a washed-out quality to everything, and we noticed that the image did tend to lack sharpness towards the edges of the screen – only slightly, mind you, but enough to notice if you look hard enough.

On the positive side, though, it's an okay 27" monitor, and the curve certainly draws the eye in and fills the user's peripheral vision. If you were using this monitor on its own and not in a comparison against other curved screens, you would probably be quite happy with the results. And as an added bonus, the built-in speakers are pretty good too.

The Dell SE2716H isn't a bad curved monitor. There's plenty to like about it, and the build quality is very good indeed. Although the image isn't as good as some of the other screens in this group, it's enough to satisfy most users and the price isn't too bad either at around £265.

micro mart
6 Quality
7 Value
6 Overall

Curved Monitors

LG 34UC88

micro mart

8 Quality
6 Value
8 Overall

L G is known more for its range of TVs than its monitors. Historically, the company's range of monitors have always felt a little drab next to similar priced and specified screens. However, this may all change with the 34UC88.

The LG 34UC88 is a large 34" IPS monitor with a resolution of 3440 x 1440 and a screen curvature of 1900R. It has a dynamic contrast ratio of 5,000,000:1, typical brightness of 330cd/m2 and is FreeSync enabled.

Connectivity is very good, with a pair of HDMI ports, DisplayPort, two USB 3.0 ports and optical out, all of which are located in a vertical panel next to the large monitor arm. There's a reasonably high degree of ergonomics; the monitor can tilt from -5° to 20°, and you can adjust the height to a maximum of 120mm.

As for the image quality, the LG 34UC88 doesn't disappoint. It offers a remarkably clear and sharp image, and the colours are vibrant and deep, with good black levels too. LG has improved the image by including a Black Stabiliser and a Dynamic Action Sync feature that lessens the lag time. There are also various game modes available, which brighten or increase the colour levels, depending on the genre of the game: FPS, RTS and so on. In our tests, we found the custom levels to be more than adequate across all games, videos, images and standard desktop duties.

It is a big monitor to have on your desk, but the 21:9 ultrawide aspect means you can comfortably have a couple of desktop instances opened up without too much loss of content. LG has even included a screen split mode, whereby you can opt for two side-by-side screens (internet and Word, for example) or a three-screen or even four-screen split. While the two-screen split works well, the three and four split screens do feel rather cramped, even on a monitor of this size.

⌃ The LG 34UC88's screen quality is excellent

⌃ Connectivity is good too, but it costs over £600

As you can imagine, the LG 34UC88 isn't cheap; in fact, it costs in the region of £620. However, although expensive, it's still a little cheaper than the BenQ and Philips models and, what's more, the image quality is significantly better.

The LG 34UC88 has changed our minds with regards to LG monitors not performing as well as its TVs. It's a great-looking monitor, with plenty of features and an excellent display, but at quite a cost. If you're up for spending that much, though, you're better off with the LG 34UC88 than most of the other screens in this group test.

Acer XZ350CU

DETAILS
- **Price: £570**
- **Manufacturer: Acer**
- **Website: goo.gl/QD5o3H**
- **Requirements: HDMI, DisplayPort graphics card, AMD GPU for FreeSync use**

Acer's new XZ line of gaming monitors are designed to offer the best curved screens possible, while still keeping the company's Predator line features and reasonably low price.

The XZ350CU is the oldest of the XZ line, being released around the beginning of the year, with the other models released just a few weeks ago. This particular model is a 35" VA LED panel with a resolution of 2560 x 1080, a refresh rate of 144Hz and a response time of 4ms.

It has a 2000R screen curvature, 21:9 aspect ratio, a contrast ratio of 100,000,000:1 and typical brightness of 300cd/m2. It also features FreeSync technology and a four-port USB 3.0 hub, as well as a pair of reasonably good 7W speakers.

Connectivity is pretty good: a single HDMI, a pair of DisplayPorts and even a mini DisplayPort too. Thankfully, there's a DisplayPort cable included in the box, as well as HDMI – something a lot of monitor companies tend to omit from the packaging.

The screen quality was good in our tests. It was reasonably sharp, and the colours were deep and vivid enough for gaming and everyday use. And as with most of the screens on test, it's only when you have this monitor side by side

with another you can begin to appreciate the differences. On the whole, it offers a decent image output, and the FreeSync element helps too.

The monitor design doesn't feel quite up to scratch, though, when compared to the likes of the BenQ, Philips, LG or Samsung models. There's considerable creaking and stiffness when moving the

monitor through its tilt and 100mm height adjustment, and the glossy bezel does feel like it's about to fall apart in your hand should you move the screen.

However, focusing on the positives, the USB hub and connectivity, along with the FreeSync, blue light reduction and its ergonomics are an excellent addition to the

⌃ The Acer XZ350CU has good connectivity and ergonomics

⌃ Sadly, the image quality isn't as good as the other 30-plus-inch curved monitors

monitor and set it above those that lack these extras.

As you would expect, as a 35" monitor, it isn't cheap. But Acer has managed to include all these features for the relatively reasonable price of £570. Naturally, that's still a fair amount of money for a monitor, especially one that isn't as good in terms of build and image quality as others this week.

While good on connectivity, then, the Acer XZ350CU doesn't really match up to the other 35" screens in the group. If you're going to be spending this kind of money, then it's worth you saving a little more and opting for something like the LG.

Samsung LC27F591FDUXEN

Although it's not as large as other monitors here, the Samsung LC27F591FDUXEN is by far the best in terms of image quality.

The curve is quite subtle and works a treat. And there's a sharp, colourful image waiting for those who hook one up to their systems. It's also reasonably priced.

LG 34UC88

We were quite impressed with the LG 34UC88. Although it's going to set you back £620, it's the best of the 30-plus-inch curved monitors available.

It offers plenty of connectivity, and the screen image is excellent.

How We Tested

Each monitor was tested with an AMD RX-480 and Nvidia GTX-1070, displaying a mixture of games, videos and still images. Where possible, we used the correct graphics cards with any GPU-specific features to reduce tearing and improve the screen quality.

	BenQ XR3501	Samsung LC27F591FDUXEN	Philips BDM3490UC/00	Dell SE2716H	LG 34UC88	Acer XZ350CU
Price	£650	£240	£680	£265	£620	£570
Screen Size	35"	27"	34.1"	27"	34"	35"
Curvature	2000R	1800R	3800R	1800R	1900R	2000R
Response Time	4ms	4ms	5ms	6ms	5ms	4ms
Max Resolution	2560 x 1080	1920 x 1080	3440 x 1440	1920 x 1080	3440 x 1440	2560 x 1080
Typical Contrast Ratio	2000:1	3000:1	1000:1	3000:1	1000:1	2000:1
Connectivity	2xHDMI, DisplayPort, mini-DisplayPort	DisplayPort, HDMI, VGA	3xHDMI, DisplayPort, 4xUSB 3.0	2xHDMI, VGA	2xHDMI, DisplayPort, 2xUSB 3.0	HDMI, 2xDisplayPort, mini-DisplayPort, 4XUSB 3.0

Component Watch

We love a mechanical keyboard, and at these prices we think you will too...

This week in Component Watch, we're looking at Mechanical and Gaming Keyboards. The thing here is that if you've never used one you can't know exactly how good they are – but you'll just have to believe us when we tell you that some of these deals are so good, we wouldn't want to miss out. Whether you're a gamer, a dedicated worker who wants something a bit more comfortable to type on (if not uber discreet) or just looking to get the best hardware available, these keyboards are exactly what you need.

Deal 1: Cooler Master Quick Fire XTi
RRP: £144 / Deal Price: £90

If you'd like a gaming keyboard that isn't trying to pretend it was originally constructed as part of a sci-fi movie set, the slim, no-fuss Quick Fire XTi from Cooler Master is a pretty safe bet. It's still got all the features you'd want out of a high-end keyboard – four macro keys, Cherry MX Brown switches and per-key multicolour backlighting, but it's also discreet enough to use at work as well should you want to. That alone represents a combination rare enough to make it worth investigating, especially when there's over £50 to be saved on the RRP.
Where to get it: Scan (**bit.ly/2aEaVJX**)

Deal 2: SteelSeries Apex M800
RRP: £159 / Deal Price: £130

Designed for speed of response and customisability, the Apex M800 contains QS1 switches with 25% faster actuation times and a super-short 3mm throw depth. The low-profile board is still compact and easy to use, though, and it features a dedicated onboard CPU that sole purpose it to process key presses in order to ensure there's no ghosting (keystrokes being lost because too many keys were pressed at once). In fact, the Apex can apparently handle you pressing 256 keys at once, and they'll all still register. The addition of the Macro support and full-colour backlighting make this a keyboard worth investigating – especially given the price!
Where to get it: Zavvi (**bit.ly/2aHgVlx**)

Deal 3: Razer BlackWidow Chroma
RRP: £170 / Deal Price: £145

Razer's gaming peripherals are always great value, and the BlackWidow Chroma is no exception. Its full RGB backlighting allows for 16.8 million colours, and a 10-key rollover means you should never miss an input. Its custom-made microswitches have gold contacts for maximum conductivity and an anti-dust mechanism that'll keep the interior clean where it matters.
Where to get it: Scan (**bit.ly/2aMklVZ**)

Deal 4: Logitech G910 Orion Spark
RRP: £200 / Deal Price: £150

Logitech has long been a reliable maker of quality, low-priced hardware, so if it's charging this much for a keyboard you know it's going to be playing on the same field as much more expensive ones. Romer-G switches, nine programmable buttons and multicolour backlit keys mean that this gaming keyboard more than looks the part, and we hope you'll agree that at 25% off it's worth the money.
Where to get it: Currys (**bit.ly/2axx91q**)

Deal 5: Corsair Gaming K95
RRP: £207 / Deal Price: £175

From the gaming hardware experts at Corsair, this keyboard features Cherry MX Brown microswitches for a top-quality typing experience – as well as full RGB backlighting, 122-key rollover anti-ghosting and 18 dedicated G-Keys that can contain over 100 different macros. Furthermore, every key is independently programmable to do exactly what you want them to do. It's not cheap, but you won't find a better keyboard.
Where to get it: Box (**bit.ly/2aX0sy4**)

Podcast Round-up

James Hunt takes offers up another dose
of downloadable delights

I n the second instalment of our podcast roundup feature, we're looking at some of the best movie podcasts. There's no doubt that there are enough movie podcasts around to fill these pages month after month, so if you've got a favourite and it isn't featured it's probably just because we haven't gotten to it yet – but feel free to let us know on the usual address. For now, enjoy this selection…

Kermode and Mayo's Film Review

Released every Friday, hosts Mark Kermode and Simon Mayo give their verdict on the week's cinema releases, big and small, as well as interviewing the big-name stars most podcasts simply can't get access to. Recent examples have seen Chris Pine and Zachary Quinto talking about *Star Trek Beyond*, and Matt Damon and Paul Greengrass talking about *Jason Bourne*. It's part of the BBC's podcast output, so the quality is always high, and Kermode and Mayo's professionalism make it an authoritative and easy listen.

Each episode lasts around an hour, and features – in addition to interviews and discussion about the week's new releases – a

quick look at the UK's top 10 movies. Kermode also runs a Vlog to accompany the program where, twice a week, he discusses a topic that hasn't been covered on the main podcast yet. There's no shortage of material and the weekly schedule means you'll always be up to date with the latest releases the very moment you can be – and in a world where podcasts are often produced by enthusiasts, the access that the BBC provides its presenters is incredibly valuable.

URL: tinyurl.com/z4yfeo7

Start With: The latest week's episode – though the archives are available in perpetuity, so knock yourself out!

Empire Film Podcast

If you only listen to one film podcast, there's a good case that it should be the *Empire Film Podcast*. Produced by the world's biggest and best movie magazine, it features a huge cast of critics, writers and guests from the films themselves discussion movies in incredibly indulgent detail providing a counterpoint to the likes of Kermode and Mayo. The *Star Trek Beyond* spoiler special, with writer Simon Pegg and Director Justin Lin, is actually longer than the movie itself, so this is no place for the casual movie fan. If nothing else, it's great to hear the professionals being asked questions about the movies you want to hear asked.

Perhaps the best thing about the podcast is that it isn't necessarily tied to a single week's releases – they cover the new stuff in close detail, of course, but the team is happy to talk about anything that gets them going. Their spoiler-filled dissections of movies are an ideal place to go when you've seen a film and exhausted discussion of it with your friends.

URL: soundcloud.com/empiremagazine

Start With: *Greatest Sci-Fi Moments Special* – released just before episode #217, this piece accompanying the magazine's feature is a great way to geek out about movies.

How Did This Get Made?

Have you ever seen a movie so bad it's good and wondered how it ever got made? If you answered yes, maybe the *How Did This Get Made?* crew can help you figure out exactly that. Their premise being that no-one sets out to make a bad movie, and sometimes the production just doesn't work.

Hosted by Paul Scheer, June Diane Raphael and Jason Mantzoukas, it side-steps the usual hate and vitriol that can get levelled at bad movies in favour of asking serious questions about what went wrong. Though don't get us wrong, it's funny too.

After debuting in 2010, the podcast has been running for almost 150 episodes, with smaller episodes in the intervening weeks. Sometimes recorded in front of a live studio audience, the show has also featured (reasonably) high-profile guests from the world of movies and comedy like Kevin Smith, Amy Schumer and Danny Trejo. You have to know your stuff to get the most out of it – not least because the movies they cover are mostly obscure flops – but let's face it, who's listening to a movie podcast and DOESN'T know their stuff?

URL: www.earwolf.com/show/how-did-this-get-made

Start With: Episode #42: *Batman & Robin* – because you've definitely seen the movie, and there's nothing that isn't fun about pulling it to bits.

You Must Remember This

If you're a movie fan – the sort of genuine film buff who watches black and white movies by choice, for example – then *You Must Remember This* is the best podcast you probably didn't know existed. Covering stories of early Hollywood history, host

Katrina Longworth creates dense portraits of a world that has passed into modern myth. Layered and deliberate, the material is complex and emotional and gripping, telling stories of the individuals who made it in Hollywood only to be forgotten, as well as those who didn't make it at all. Even if you aren't a fan of old Hollywood movies you can't help but be drawn in by the sheer human drama unfolding within each episode.

Each episode is accompanied by a huge amount of shownotes, which give context, sources and extra reference material to accompany the stories told on each one. If you're at all interested in the history of movies and Hollywood, you won't find a richer or more accessible way to enjoy them than this. The only hard part is deciding where to start.

URL: www.youmustrememberthispodcast.com

Start With: Episode #65: *MGM Stories Part 10*, the first of two episodes about David O. Selznick, one of Hollywood's great producers.

Cinematic Universe

It's often said that there are too many superhero movies nowadays. But what if you're the sort of person who enjoys them? In that case, *Cinematic Universe* might be the podcast for you. Full disclosure: this is my own podcast. But what's the point of running a podcast feature if you can't plug your own?

In each episode, host Joe Cunningham invites two comic book and movie fans to discuss a specific comicbook-based movie, pulling it apart to see what works, what doesn't, how it could've been made better and what, if anything, it's trying to say and do. Regular guests Seb Patrick and James Hunt (yes, that's me) help to contextualise the films in terms of the comics that inspired them, as well as discussing the latest superhero TV and movie news and then battling it out to see who can pitch the best movie based on Joe's studio requirements.

Released biweekly, there are over 30 full-length episodes to download and minisodes every other week in which Joe discusses the comics recommended to him in the previous episode. I'm biased, but I think it's worth listening to (I've seen the numbers – and it appears a lot of other people do too).

URL: www.cinematicmultiverse.com

Start With: Episode #6, *Watchmen* – and see what happens when a film really divides opinion.

That's all for this month, but feel free to send in your favourites if you'd like to see them featured. Next month: popular science. **mm**
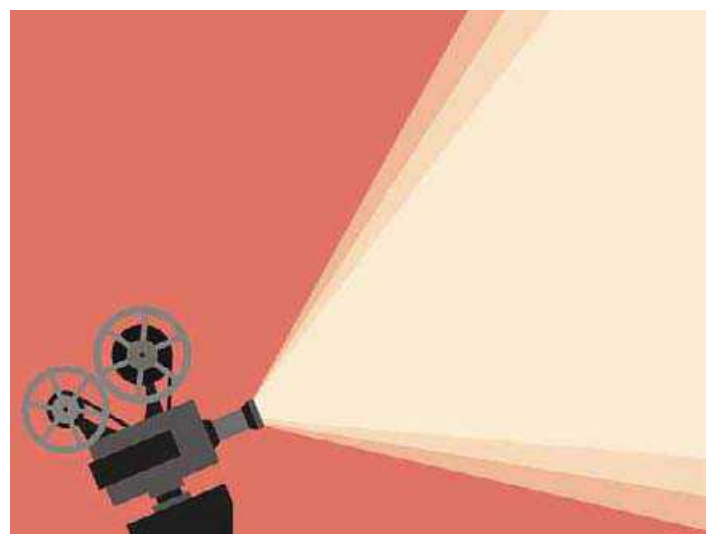
The Complete History of Home Computing

Part 2

Here's the next step on the road to the tech we know today…

The second part of our complete history of home computing begins in the late 70s, as electronic hardware finally reaches the home. So let us take you back forty years, to the real birth of home computing.

1976

1970 might be year zero for Unix-based systems, but for home computing 1976 was the point where things changed in a big way. It was, of course, the year that Steve Wozniak and Steve Jobs completed their first home computer: the Apple-1.

Apple-1

The direct ancestor of virtually the entire Apple product line, the Apple-1 was hand-built by Steve Wozniak in a garage in Sunnyvale, California after he attended the first meeting of the Homebrew Computer Club in 1975. Planning mass production, Wozniak estimated that the design would cost $1,000 to build, the parts would cost $20 per unit, and at that point the computer and its designs could be sold for $40 each. Modest, sure, but then this was a PC you built yourself – not unlike the Raspberry Pi now.

Wozniak and his friend (Apple co-founder) Steve Jobs invested their own money in the project, Jobs selling his VW Minibus and Wozniak his HP-65 calculator so that they could get the capital they needed. As a shrewd businessman, Jobs was able to secure an order for 50 completed units from a nearby computer shop at the huge sum of $500 each. The systems were rapidly assembled and delivered in just 10 days.

In July 1976, the Apple-1 went on sale priced $666.66, a one-third markup on the $500 wholesale cost. Around 200 were made in total, and all but 25 sold.

The Apple-1 was the first general-purpose fully electronic computer sold to the general public as a pre-assembled unit, instead of as a kit. Users did still have to add a number of components – a case, power supply, keyboard and VDU – but in that sense it was essentially the same as buying a barebones bundle today. It was even capable of being connected to a television, which was an innovation at the time.

Today less than a hundred known Apple-1 computers remain in existence, partly because users who bought one were given the chance to trade them in for Apple IIs in 1977, with Apple destroying the boards thereafter.

Other Notable Events

1976 was most eventful for Apple, but that doesn't mean there wasn't more going on. While Jobs and Wozniak were selling their earliest computers, the IBM-compatible was also moving off the starting blocks: In 1976, Intel began designing the 8086 CPU, the chip that would power the first IBM PCs and give rise to the x86 architecture that still powers modern systems.

It was also the year that Japan began to produce DRAM (Dynamic Random-Access-Memory) chips, after the Japanese Trade Ministry grabbed its chance to make Japan a leader in the emerging field of computing electronics. DRAMs became the first mass-market memory chips and the Trade Ministry even funded a number of companies – Fujitsu, Hitachi, Mitsubishi, NEC and Toshiba – to develop more advanced 64K DRAMs. DRAM technology remains in use today in modern PCs to this day, in a vastly advanced form.

Finally, it's worth noting that 1976 was also a big year for royalty, both of the literal and computing kind. In March, Queen Elizabeth II sent her first email at the Royal Signals and Radar Establishment in Malvern to demonstrate the latest networking technology, and in December Bill Gates dropped out of Harvard with a plan to devote all of his time to his fledgling software company. He'd trademarked the name the month before, after making one small change: dropping a hyphen, the company became known as simply "Microsoft".

1977

The year punk broke and the year *Star Wars* got released, 1977 was already culturally huge. It also heralded the arrival of two major pieces of home computing history.

Apple II

The success of the Apple-1 meant that a follow-up was inevitable. Building on the successful qualities of the system, the Apple II was the first home computer that looked anything like one you'd recognise today. Sold fully assembled, it was no longer aimed at hobbyists and tinkerers. First sold in June 1977, the Apple II would remain in production one way another for a further 17 years, though sales would peak in 1983.

The original 1977 model used a 1MHz MOS Technology 6502 processor, with 4KB of RAM and an audio cassette interface. Its video controller could display 24 lines of text with up to 40 columns, in glorious monochrome – though by outputting an NTSC TV signal it could also display graphics in full colour, which is why Apple added rainbow stripes to their logo (where they'd remain until 1998.

The unit retailed for the princely sum of $1,298, though if you wanted the maximum 48KB of RAM it'd cost you an even pricier $2,638. The open design philosophy and inclusion of expansion slots in the unit meant that third party devices could be manufactured for the Apple II, making it versatile in ways that are expected of a modern computer. The original model spent four years in production and sold 40,000 units in total, before being replaced by the Apple II+.

Atari VCS

Personal computers were only half of the home computing story. The other half? Games consoles. The prime example being the Atari VCS (Video Computer System), also released in 1977. You might better know it as the Atari 2600.

Sold with two joysticks, a pair of 'paddle' controllers, and a single game cartridge (originally *Combat*, and later *Pac-Man*), the Atari VCS was the first modern games console. Previous games consoles used custom logic circuitry, but the Atari VCS had a reduced version of the MOS Technology 6502 processor running it (the 6507) meaning that it could be used to run general code and thus more games. It had just 128 bytes of RAM allocated to games and its CPU ran at 1.19 MHz.

While most devices at the time used cassettes or disks to store their programs, or fixed ROMs, the Atari 2600 used interchangeable ROM cartridges, allowing games to load effectively instantly. This remained a popular way to use consoles for decades

▲ *Apple-1*

▲ *Atari 2600*

▲ **Apple II**

▲ **VisiCalc**

➤ **Laserdisc with CD and Mini CD**
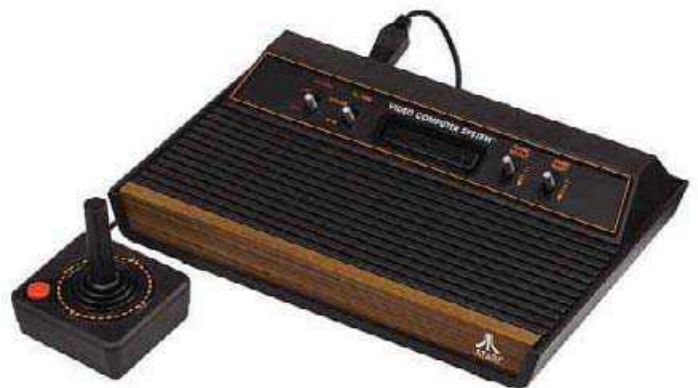
after, right up until the original PlayStation made optical discs the dominant media format for games.

When it was released, the Atari VCS cost $199 (almost $800 adjusted for inflation) and had a total of eight games available. Home gaming was already broadly popular thanks to the simple, Pong-running systems that had come before it, and Atari rode that wave to sell 250,000 units worldwide in 1977 alone. Two years later it would sell a million units.

Other Notable Events
1977 saw a number of prebuilt home computing systems released, though none so significant as the Apple II. If anything can reasonably compete, it's probably the Commodore PET (Personal Electronic Transactor), which came fully assembled with 4- or 8KB of memory, a built-in cassette drive, a monitor and a membrane keyboard. It ran a MOS Technology 6502 processor at 1MHz, and its success turned Commodore into a serious player in the computing market. The original model retailed for $495.

1978
As home computing hardware started to take off, 1978 saw the development of major applications for these new devices.

Computing Applications
For example, Dan Bricklin and Bob Frankston developed the first ever spreadsheet software, known as VisiCalc. Written in Apple BASIC, it was eventually sold to the Lotus Development Corporation and evolved into a program known as Lotus 1-2-3. Elsewhere, Rob Barnaby created a program called WordStar while working for MicroPro International. Originally designed to run on CP/M, but later ported to DOS and Windows, it was the first fully-featured piece of word processing software – though it was later imitated and surpassed by Microsoft Word.

In February, the first ever Bulletin Board System (BBS) went online. These small networks connected multiple users who dialled in using landlines and the earliest modems. They were essentially a precursor to the modern Internet, allowing ordinary people to chat and share files from home with relatively few special access requirements.

The first public BBS – launched by Ward Christensen and Randy Suess – was born out of a blizzard. When their home town of Chicago was snowed under, the pair began working on a Computerised Bulletin Board System. Christensen owned a space S-100 computer with a spare modem, while Suess had a house in central Chicago that would provide a low-cost local number to millions of users. Patterned after the cork noticeboard at his computer club, the CBBS served over 250,000 callers before it was retired.

Along similar lines, Roy Trubshaw and Richard Bartle created the first MUD, or 'multi-user dungeons'. These were text-based virtual environments that allowed players to share an adventure game similar to Dungeons And Dragons. Established at the University of Essex, it was inspired by text adventures like *Zork*.

Meanwhile, the Internet as we know it was also being pushed closer to existence. In 1978, TCP technology was split in half to become TCP/IP – the addressing system that still runs modern network and Internet traffic.

Disks & LaserDiscs
No discussion of 1978's impact on computing could pass without mentioning storage technology, though. In 1978 two major developments occurred.

The first is that the 5.25" diskette, first developed in 1976 by Shugart Associates, became an industry standard. Replacing the 8" standard, considered too big for a standard PC, the 5.25" 'diskettes' were quickly adopted by multiple manufacturers, and by 1978 over 10 different companies were producing them, ensuring their popularity for the immediate future. With a 360KB storage capacity, their capabilities were minuscule by modern standards, but their durability and convenience meant they stuck around for years before being replaced by higher capacity formats.

By comparison the LaserDisc never quite caught on like that, though it remains an important development in storage technology. Introduced as "DiscoVision" by MCA and Phillips, the Laserdisc was essential an LP-sized optical disc which contained digital copies of movies. Unfortunately, Laserdisc players were prohibitively expensive and the format wasn't particularly convenient. Despite its higher quality sound and picture, it gained limited popularity outside Asia – though it did lead directly to the development of smaller, high-density versions: CDs and DVDs, both of which would change the face of home entertainment and computing.

That brings us to the end of this month's instalment, though. Next month, we'll be looking at 1979-1981, featuring the development of the first 'worm', the launch of the IBM-PC, and the debut a little thing known as the Sinclair ZX80… **mm**

Remembering...
Feud

David Hayward looks at one of the best examples of budget games this week

We've already looked at Matertronic here, with its often excellent budget titles that could keep us as entertained as any full price game. This time, we thought we'd look at one of those games, from the Mastertonic Bulldog stable.

Feud was a superb budget arcade adventure released in 1987 to much acclaim, earning the coveted Crash Smash award (even becoming the subject of that month's *Crash* cover, March 1987). Costing a mere £1.99, this wonderfully addictive game saw you playing as one of two wizard brothers, Learic and Leanoric, who had had an argument that had escalated into an all-out magical war.

You played the part of Learic, whereby you had to navigate the expansive map finding a variety of herbs and plants that when combined, would make up a specific spell from your spell book. Once you had a collection of spell ingredients, it was back to your area of the map, where you could mix the ingredients in your cauldron to activate the spell. After that, you could then hunt out your brother and use the spells to defeat him with combinations of your wizardry arsenal.

There were some marvellous features at work in this game: the impressive size of the playing area; the often cunning locations of the herbs and their respawn times; the random villager who could be turned into a doppelgänger or a zombie in order to injure or lure Leanoric; and the tick-tick sound of you walking, followed by the piercing alarm bell denoting Leanoric's sudden appearance.

It did suffer from a horrendous case of colour clash, mind you. The many coloured villagers you encountered would merge with your stark white character and create a sickening hue for a brief moment, as did some of the foliage when you passed by. However, you got what you paid for, and for £1.99, you couldn't really argue with this little gem.

Its History

Developed by the Pickford Brothers, John and Ste Pickford, along with Pete Harrison and with spot sound effect by David Whittaker, it was the first game from the new Bulldog label and had taken some time to get going from its initial concept on paper to finally reaching the shelves in Woolworths. And since this was the first title from Bulldog, there was an increase in pressure for all involved, with a team of developers, careful planning and so on, as opposed to the usual 'fly by the seat of your pants and make it up as you go' method of game development.

There were a few problems with the C64 version: John Flynn, who wrote *Feud* for the C64, was freelance and didn't stick to the game design plan (allegedly).

Did You Know?
- The game appeared on four different compilations since its release.
- Ste Pickford drew all the loading screens for all versions of the game.
- There was a PC version too, available on the My Abandonware site.
- Over 260,000 copies were sold across eight different platforms.

But the game sold well, at over 60,000 copies on the major platforms – and even an Amiga version was made.

The Good

An excellent and playable game, with some fiendish tactics needed and a huge map to explore.

The Bad

On the Spectrum, the terrible colour clash. On the C64, Leanoric's position often messed up due to the programmer not following the AI code.

Conclusion

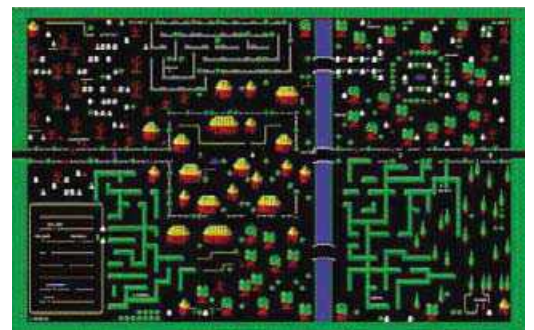*Feud* was a cracking budget game and one that I still play to this day. Thank you, Pickford Brothers, for teaching us how to mix herbs! **mm**

⌃ *As Learic, you have to explore the world gathering herbs to mix against your brother, Leanoric*

⌃ *The villagers are mostly harmless, except for the bloke in the herb garden in the bottom corner of the map*

⌃ *The map was huge and quite a feat for just 48KB*

RETRO ROUND-UP

This month, Dave Edwards has got the whole of the retro world in his hands

Welcome to another month's retro roundup. When I started this column several years ago, a number of people asked me if I would really find enough publishers releasing new games for old systems to fill four entire pages every month. As someone who was heavily into the retro scene, I had no hesitation in replying 'yes' – and, if anything, over the years in between, my simply being responsible for this column has introduced me to lots of retro content I would otherwise have missed.

At some point – perhaps next month – I might take a break from reviewing games for a page or so in favour of charting all of the different sites, YouTube channels, and forums that I regularly peruse just to keep abreast of what's new. Two places that have been particularly invaluable, in terms of both research and entertainment, are Retro Revisited's YouTube channel, where you'll find his own latest Retro Round Up at **tinyurl. com/hucnh5b** and the excellent daily news reports at **www.indieretronews.com**.

Neither site takes the same approach as I do in this column; they don't critically appraise new games, they just report new releases. For that reason, they do pack a lot of retro-related news into each month. While this column has occasionally seemed to groan under the weight of new Spectrum games, I'd estimate the Spectrum actually only accounts for a fifth of their output. They cover not only new homebrew games but cracks, previews, demos, competitions, Kickstarter projects, books and gaming conventions.

With these sites as inspiration, however, this month I've decided to cast the retro net a little wider. So we'll be looking at five new games and one old one, and for the first time, giving coverage to the MSX and the Colour Genie as well as the Spectrum and Amstrad. So, without further ado, let's see what's new…

Angry Birds: Opposition (Free)
by kas29 for Spectrum 48K/128K
tinyurl.com/gnwfsxy
The *Angry Birds* games have proved a phenomenal success on modern machines and now they're coming to a Spectrum near you. Well, sort of. Because, although A*ngry Birds: Opposition* features the same lovable sprites as the original, it is actually completely different.

You are in control of a big gun, situated at the base of the screen. Just below it is a tug rope between the 'birds' on the left, and the 'pigs' on the right – and dead centre of the tug rope is a cart. As each level begins, a solitary bird begins to fly across the screen.

A quick blast from your weapon and he disappears into a rather nicely animated poof of feathers... upon which the cart quite satisfyingly moves one place toward the pigs. Miss, however, and the cart will return to the centre. Miss several times and it won't be long until it's pressed up close to the birds and they will claim victory, ending your game.

The aim is, naturally enough, to blast enough birds that the cart presses up against the pigs on the right. Doing so lets you proceed to the next screen.

Created by World Of Spectrum member kas29, *Angry Birds: Opposition* starts off with a deceptive lack of action. The birds move at a fair pace and your stationary gun base deals with them without much problem. However,

on screen three, the backdrops start changing and your gun starts gliding uncontrollably back and forth. This ratchets up the difficulty, leaving you less time to react to the birds. Then, just when you're getting the hang of that, the birds change their flight paths.

There is an impressive amount of variety to this game. Screen backdrops, gun handling, and bird behaviour slightly alters every time you manage to shoot enough birds to clear a level. On level six, for example, the screen features a house, and the birds fly behind rather than in front of it, meaning you need even more skill to pick them off when they emerge from its shadow.

In fact, despite its very simple premise and the fact it's all operated with a single fire button, the game is fairly impressive. The only real fault with it is that it doesn't have the smooth scrolling you might expect. The birds move at a fairly regular speed, and I didn't have any difficulty knowing when to hit to stand a good chance of striking them, but their movement is jerky rather than fluid, which is somewhat distracting. There's also a peculiar vertical scroll upwards when you do win a level.

▲ *Birds Vs. Pigs In Angry Birds: Opposition*

▲ *The birds attack, like in that movie...*

▲ *A house offers the birds some cover*

⌃ *What A Feeling's playing in the background*

⌃ *Supersonic controls make Transball too hard*

With a great loading screen and some nice introductory music, it's all put together with quite a lot of finesse and it's so addictive that I did wind up playing it for a good hour or two.

Transball (Free)
by Villar Software for MSX
tinyurl.com/hgef3nr

Transball is a new game for the MSX produced by Villar Software, and it's basically a version of the classic *Thrust*. For those of you who've lived in a cave for the past three decades, or forgotten those computer gems of your youth, *Thrust* is the one with caverns, gravity, lots of careful inch-by-inch manoeuvring and spheres that must be liberated to the top of the screen. Here, however, that age-old formula is applied with one large modification, which we'll look at later.

The action takes place in the MSX's seven colour mode with 8x8 CHR$ definitions taking the place of the vectors which defined the original. You spin a cyan ship through 360°, trying not to collide with the walls of the caverns, biding your time near to the forcefield-style doors and shooting any gun turrets that give you a hard time.

I've played a few versions of *Thrust*, and *Transball* combines elements that made some of them infuriating. Firstly, the ship is overly sensitive, rotating quickly on its origin and leaping forward at the slightest touch of the thrust control. This takes quite a bit of getting used to. You could probably master it, though... were it not for the jumpy vertical and horizontal scrolling. The best I could say about this scrolling is that it's disconcerting. I'm sure others would say a lot worse.

Those issues make *Transball* needlessly difficult, but not impossible. There's another problem to add, however: the ship is almost triangular, and if your attention wanders for a second, it can be hard to tell what direction it's pointing in. The original *Thrust*'s ship has a

distinct nick where the thrusters were, which got around this issue.

If you can stomach the nail-biting crusade through the caverns to begin your 'trans-fer' of the 'ball' (as per the game's name) to the top of the screen, you may be pleasantly surprised to find that, unlike *Thrust*, all you need to do in *Transball* is fly close for it to immediately attach itself.

This is the large modification to which I referred earlier. There is no dropping of a lasso or *Thrust*-style tractor beam here. The ball simply turns blue to indicate its capture. Indeed, there's no corporeal connection between the ship and ball at all; its new colour is the only visual cue – and your ship's grip on the ball can be easily broken if you simply thrust in one direction a little bit too fast. Doing so can easily see your prize flung off into a different section of cavern, and you'll then have to spend precious time retrieving it.

Having criticised it somewhat, it's worth noting that the game does have an amazing intro, which includes a cool variation of Eighties music classic *Flashdance: What A Feeling*, going for it. It also has a large number of levels, a password system and no life limit (it simply lets you keep trying the level you've reached until you complete it or quit the whole game).

The game itself doesn't quite pass muster, though. Sadly, it's just too tough for all but the most hardened arcade addict.

Regreso Al CPC (Free)
by Antonio Cuenca for Amstrad CPC
tinyurl.com/jq88os2

Last year's *Back To The Future* 30th anniversary saw CPCRetroDev's annual game-writing competition receive a slew of entries based on the famous Michael J. Fox time-travel movie. *Regreso Al CPC*, literally *Back To The CPC* in Spanish, was one of them.

Having travelled back to 1985 to source components for your broken Amstrad the games requires you to travel along a never-ending road in a DeLorean, running over Eighties memorabilia (cardboard 3D glasses, skateboards, and headphones), avoiding the energy draining Sports Almanacs as you go.

You may have noticed, then, that the backstory bears no relation at all to what you actually have to do. However, what is worse, however, is that Marty may actually have hit 1980 rather than 1985 as the style of play reminds me of the dark age Tandy CoCo games. The potential of the Amstrad is only really experienced in the groovy opening and closing musical accompaniments, sadly.

It's very unsophisticated fare, with controls limited to up and down and very little incentive to play at all! Music aside, I suspect the game was only a weekend's work. Next!
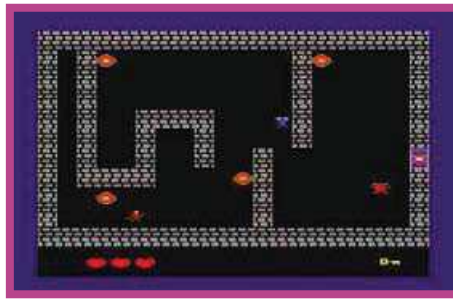
⌃ *Pulsa Una Tecla means Press Space. Habla espanol?*

⌃ *The soundtrack is Agnes' "On and On". Not really*

⌃ *Bonfire has a simplistic feel to it*

⌃ *The orange blobs are the bonfires*

Bonfire (Free)
by Mythia Fire for Amstrad CPC
tinyurl.com/zu5y8g5

Overhead maze games with patrolling nasties exist in their thousands, and practically every idea has been tried. So it was with mixed feelings that I tackled *Bonfire*, a game for the Amstrad that invites you to progress through each overhead maze, collecting the key and fighting your way to the door. Fortunately, there's more to it than first meets the eye...

You play an Indiana Jones-style explorer, sporting one of those open torches of the 'rag wrapped around a branch' type, and your aim is to keep that torch alight using the roaring bonfires scattered throughout each maze (hence the name). When it is alight, you are impervious to any of the patrolling enemies. As soon as it goes out, they home-in on you at startling velocity.

Therefore, the strategy you must employ is to cross the maze by running from one bonfire to the next. Unfortunately, although a bonfire will light your torch, it will only remain lit for only sixty steps – and, of course, there are often around seventy steps separating each of

the bonfires. Hence the game is one of skill, timing, and patience.

Now if all that sounds encouraging, let me warn you that *Bonfire* is still a little rough around the edges. One particularly discouraging feature, for example, will confront you the very first time you play. You start with three lives at the end of a very long corridor; the first bonfire being guarded by an enemy at the end of it. Get the timing of your run towards the bonfire wrong and not only will you be picked off by the enemy, but he will then stand unflinchingly at the end of the corridor. This leaves you no other option than to suicide-charge away your other two lives in order to start again!

Some things about this game don't really make sense – the torch doesn't appear to burn if you stand still – but it's an overhead maze idea I haven't seen before, so I'll give it a thumbs up for originality. it's graphics and sound, however, leave a lot to be desired.

RETRO FIND OF THE MONTH
Dizzy In The Dungeons (Free)
by Dr Titus for PC (Windows)
tinyurl.com/zwalmok

The original eighties *Dizzy* was the story of an egg searching for the ingredients for a magical potion and starred an egg-shaped character of the same name. Oddly, when you consider *Dizzy* appeared on the vast majority of 8-bit formats, its egg-shaped hero became almost synonymous with the Spectrum. Wed in much in the same way as

Mario to the SNES, or Repton to the BBC, Dizzy was almost crazily popular. It was more than just 'another graphic adventure'; it was a game that just seemed to get all of its elements right.

In the eighties, the world was also a smaller place and, rather fascinatingly, it wasn't just the English that were going gaga over this Prince of the Yolkfolk. Courtesy of a thriving black market for Spectrums behind the iron curtain, Russian geeks also grew to love him.

Fast-forward 30 odd years and you'll find there are more English and Russian *Dizzy* games available than you can ever hope to play in your lifetime. Indeed, there's even an annual competition to design the best new *Dizzy* game. This year, contributions came in from all over the world, and this game – *Dizzy In The Dungeons* – won it.

So, importantly, is it any good? Well, as you can imagine, being released for Windows PCs – rather than packed into the average 48K most of the *Dizzy* classics had to content themselves with – does give it an injection of superior graphics and sound. What's really nice, though, is that the core dynamics of the game remain the same. *Dizzy In The Dungeons* retains the platforms, objects, puzzles and that oh-just-a-little-bit-uncomfortable jump feature that we all remember.

There isn't a lot of backstory. Nor is there a cauldron, or evil Zaks to defeat. All the instructions tell you are that you must help Dizzy and the Yolkfolk escape their dungeon prison. That's all you need, though.

If like me, the majority of Dizzy adventures you've played were flick-screen affairs, you may find this smooth-scrolling *Dizzy* game somewhat unusual. It starts by setting you a single puzzle that, once completed, will allow you to escape the small prison room in which you are trapped. The solution is remarkably simple, but not readily apparent, which is a feature of many of the puzzles to

Bonfire
Graphics 25%
Sound 34%
Playability 65%
Overall 41%

⌃ *The legend of Dizzy will never die*

⌃ *The puzzles have greater depth than the original*

⌃ *About to pick up another key*

▲ *Jet Set Billy is a relatively unknown Colour Genie game*

▲ *Similar, but different, to Jet Set Willy*

▲ *Now, is that a bow top-right of the screen?*

come. So a word of warning: don't do as I did and head over to YouTube to watch a quick video of *Dizzy In The Dungeons'* gameplay. Because, unless you're careful, you'll end up spoiling this first puzzle for yourself if you do. Just take my word when I tell you it's more than worth downloading and playing.

The scrolling is incredibly smooth and an extremely nice effect is that if Dizzy builds up some extra speed when falling in a certain direction, the screen allows this and then slowly catches up with him to keep him centre-screen. This kind of effect, which likely takes more memory than the entire code that powers many Dizzy games, makes this game stand out as a truly professional release.

There are other nice touches too – you move around with the arrow keys, but all getting and dropping of objects is handled by an intuitive menu system. Pressing ENTER picks up an object and immediately selects a menu with 'Exit And Don't Drop' selected, so a 'double-click' on ENTER picks up any object. To use an object, you hit ENTER, bring up the menu, select the object you want to use and hit ENTER again. Difficult to go wrong there.

All these features make it all the more astonishing that *Dizzy In The Dungeons* is all the work of a single die-hard Dizzy fan: David O' Flynn. He has been working on it for over seven years, in fact.

if you ever had even a passing interest in *Dizzy* games back in the day, it would be a crime to miss such an impressive game, produced with no Kickstarter backing and being given away for absolutely nothing.

Dizzy In The Dungeons
Graphics 77%
Sound 72%
Playability 84%
Overall 78%

Jet Set Billy (free)
by Arcade Games for Colour Genie
tinyurl.com/z4zqzuy
Jet Set Billy is not a new homebrew game - it's a game from 1984 for the Colour Genie (an also-ran computer from the eighties). In it, you play Billy and, to the strains of *If I Were A Rich Man*, you are required to traverse a number of screens collecting money bags and avoiding the roaming devils with pitchforks. Quite remarkably, it all fits inside 16K.

There are a number of reasons why I'm giving it a quick once-over this issue. The first is that the Genie's games range from the lamentable to the dross, and it's one of only a few examples that is worth playing. The second is that Colour Genie emulation has been lost to the last generation of Windows users, because the only available emulators for this system only ran on the 486 PCs. That has all changed now, though, with the release of Atilia Grosz's Genieous emulator. The third is that I have been wanting, for a while, to at least give the Colour Genie a bit of column space because I've been hard at work buying up any Genie cassettes and magazines that have found their way onto eBay over the last few years. The result is that I have made quite a sizeable collection of exclusive Colour Genie games available, completely for free, over at **everygamegoing.com**.

Jet Set Billy, however, is not a game that I have managed to locate in the flesh. In fact, I only found a .CAS file of this British game hiding in a somewhat obscure German database of retro software almost by chance.

Although you might think, given the obvious similarity, that there would be little difference between this and its almost-namesake *Jet Set Willy*. The games bare little resemblance, however. If anything, *Jet Set Billy* seems to have more in common with the original *Manic Miner,* as the game is a purely linear one. You'll only escape room one by collecting all the moneybags to proceed to room two, and so on.

Anyway, I originally picked up *Jet Set Billy* with a view to fully reviewing it this issue only to find that no instructions for it have survived. As we've experienced before in this column, if a game has no instructions it can lead to certain of its features being completely overlooked. In the case of *Jet Set Billy*, there is an inclusion that seems such a game-changer, even hardened *Jet Set Willy* players might consider firing up Genieous and having a play.

What is this inclusion? Well, Billy can actually fire arrows at the patrolling baddies! Which, if you're used to the pixel perfect positioning and jumping of Willy in the *Jet Set Willy* games, is extremely surprising.

Alas, although Billy can fire arrows, I'm not exactly sure how. Because no instructions have survived, and because so far the furthest I can reach is screen two, I don't know if he needs to collect a bow first to fire them, or whether I just haven't located the game control key that would loose one off.

So it's here, Retro Round-up readers, that I'm actually asking for your help. Does anyone remember this game? Does anyone have instructions for it? Is its author, R. Hamilton, reading this? Or can anyone reading this get further than I can and shed any further light on the mystery?

As you can see from the screenshots, Billy has four arrows from the moment he plunges down the well in his garden and starts the game. Can anyone somehow get him to fire one of those arrows and let me know how to do it?

In the hope of receiving a message on Everygamegoing's Facebook page with an answer, I'm going to hold off on actually scoring Billy's antics but give him a cautious recommendation.

That's All Folks!
That's all we have time to cover this issue which hopefully offered something for you all. As is usual, visit the tinyurls to see information, screenshots, downloads and, time permitting, brief videos of the games in action. See you next month. **mm**

Using SQLite As A Custom File Format

Mark Summerfield looks at storing data in Python

When we create applications, we almost certainly need a way to store custom data. For small amounts of data we can use .ini files – or, on Windows, we can use the registry – but for larger amounts of data (e.g., the application's notion of a 'document'), we need to create a storage format. These can be binary or plain text, custom or predefined. For example, the SVG image format is plain text (XML markup; UTF-8 encoding) and predefined, whereas the FLAC audio format is binary and predefined. In this article, we will discuss custom formats and show how to use SQLite as a custom binary format.

For custom data, plain text is very appealing. Such formats are readable by humans and tend to be much easier to debug than binary formats. Also, if we use an existing text format such as JSON or XML, libraries exist in almost every language for reading and writing them. For small documents, such formats work well, but for large amounts of data they can be quite slow to read and write, especially XML. By contrast, creating a custom binary format can be tricky, especially when it comes to when debugging. It can, however, produce very compact documents that are fast to read and write.

The main issue with both formats, though, is that they can be quite painful to change. For example, should a later version of our application needs to store additional data. We need to be able to read legacy files and fill in the gaps with sensible defaults so that they can be saved as new version files. I've tried many different solutions, but nowadays every custom document type I create is an SQLite database.

That 'Lite' suffix may make it sound flaky, but in fact it is the most widely deployed database in the world (it's used in practically every smartphone, for a start) and its test suite – at well over three billion automated tests – provides 100% code coverage, so it's also reliable.

SQLite is an in-process database, which means that it exists inside the same operating system process as the application that uses it, so it is normally used as a single-user database. Each SQLite database is stored in a single file, no matter how many tables, views, and triggers it contains, so it is very easy to use as an application's document storage format. So. let's imagine that we want to store simple card index cards – each with a title and a body:

```
class IndexCard:
    def __init__(self, title, body=None):
        self.title = title
        self.body = body
```

We could, of course, store them in memory, loading and saving them all in one go. However, if we use SQLite, we only need to read in the cards we're interested in and can add, delete, or update them individually with very little memory overhead. If our data items were a lot bigger and more complex and used a lot more memory per-item, this could make a big difference to performance.

We'll hold our cards in a model that wraps an SQLite database, and which uses the third-party ASPW library rather than the standard library's rather weaker sqlite3 module.

```
VERSION = 1
class IndexCardModel:
    def __init__(self, filename):
        create = not os.path.exists(filename)
        self.db = apsw.Connection(filename)
        cursor = self.db.cursor()
        pragma = Sql.SetVersion.format(VERSION)
        with Transaction(self.db) as cursor:
            if create:
                cursor.execute(Sql.Create)
            else:
                version = getfirst(Sql.GetVersion)
                if version < VERSION:
                    pass # Update Database structure here
            cursor.execute(pragma)
```

A model must be created with a filename. This may be an existing database of cards or a non-existent file that must be created. The Transaction class used in the code above was first featured in the 'Automated Cleanup with Python' feature back in MM issue #1420. SQLite allows us to set and get a user_version from a database.

We use it here to set our database version when creating a new database, and to check if an existing database is up-to-date. The Sql namespace is one we have created like this:

```
Sql = types.SimpleNamespace()
Sql.GetVersion = "PRAGMA user_version;"
Sql.SetVersion = "PRAGMA user_version = {};"
Sql.Create = """CREATE TABLE cards (
    cid INTEGER PRIMARY KEY NOT NULL,
    title TEXT NOT NULL, body TEXT);"""
```

++ <<<

```
Sql.Add = """INSERT INTO cards (
    title, body) VALUES (:title, :body);
    SELECT LAST_INSERT_ROWID();"""
# Omitted Sql.Insert, Sql.Update, etc.
```

A collections.namedtuple would also work, since the values aren't changed, but types.SimpleNamespace makes for an easier syntax.

```
def getfirst(cursor, sql, params=None, Class=int):
    params = {} if params is None else params
    first = cursor.execute(sql, params).fetchone()[0]
    return (bool(int(first))) if isinstance(Class, bool)
            else Class(first))
```

This is a helper function for extracting the first field from the first record produced by a query, and returning it with the correct type. We have to special case Booleans because bool("0") is True (because it is a non-empty string), but bool(int("0")) is False since bool(0) is False.

```
def close(self):
    self.db.close()
def __enter__(self):
    return self
def __exit__(self, exc_type, exc_val, exc_tb):
    self.db.close()
```

These methods allow a model instance to be used in a 'with' statement, or in a try/finally block with an explicit call to close() to guarantee finalization.

```
def add(self, card): # cid = model.add(card)
    with Transaction(self.db) as cursor:
        return getfirst(cursor, Sql.Add, vars(card))
```

This method adds a new card and returns its cid (Card ID). Python's built-in vars() function returns a key-value dictionary of the object it is given (i.e., a copy of the object's __dict__ if it has one). For IndexCards it returns a {"title": "card title", "body": "card body"} dict. APSW's cursor.execute() method takes an SQL query string and, optionally, a dict where the values correspond to keys in the query. The Sql.Add query has two statements, the second returning the new card's cid.

```
def __getitem__(self, cid): # card = model[cid]
    with Transaction(self.db) as cursor:
        row = cursor.execute(Sql.Get,
            dict(cid=cid)).fetchone()
        return IndexCard(*row) if row is not None else None
```

This special method allows us to retrieve a card by its cid. We've chosen to fail safe by returning None for an invalid cid, but perhaps a better alternative would be to raise an InvalidCidError exception.

```
def __delitem__(self, cid): # del model[cid]
    with Transaction(self.db) as cursor:
        cursor.execute(Sql.Delete, dict(cid=cid))
```

This allows a card identified by its cid to be deleted. Strictly speaking, we don't need a transaction for this method or the previous one, since they are both single statements. Using a transaction is safer, though, because if the SQL was changed to be more statements it would work.

```
def __setitem__(self, cid, card): # model[cid] = card
    d = vars(card)
    d["cid"] = cid
    with Transaction(self.db) as cursor:
        exists = getfirst(cursor, Sql.Exists, d, bool)
        sql = Sql.Update if exists else Sql.Insert
        cursor.execute(sql, d)
```

The transaction is needed here because we do two separate statements both of which must succeed or fail. The first statement is used to tell us if we're updating an existing card or replacing (really, inserting) with a new card, and the second to perform the update or insert.

```
def __iter__(self): # for cid, card in model:
    with Transaction(self.db) as cursor:
        for row in cursor.execute(Sql.Select):
            cid = row[0]
            card = IndexCard(row[1], row[2])
            yield cid, card
```

Users of our model can iterate over all the cards using this method.

If we wanted to allow a constraint (e.g. all cards with an empty body or all cards with a title containing a specific word), we would have to provide a separate method, perhaps with the signature iterate(self, where="", orderby="ORDER BY LOWER(title)").

```
def __len__(self): # size = len(model)
    with Transaction(self.db) as cursor:
        return getfirst(cursor, Sql.Count)
```

This completes our implementation. You might like to consider raising a custom InvalidCidError if a non-existent cid is passed to __getitem__(), __delitem__(), or __setitem__(). And more interestingly, you might like to add support for undo/redo, although doing so is quite a bit of work.

For those who don't much like writing raw SQL, an excellent alternative is to use an Object-Relational Mapper (ORM) such as SQLAlchemy or SQLObject. These make it possible to create Python classes such that a class maps to a database table and an instance to a database record with all the underlying SQL handled by the ORM. **mm**

Don't Get Burned By Data Bills

How to avoid getting mobile phone 'bill shock' when you return from your hols

When a holiday looms, the excitement builds. "This time next week," you'll tell everybody in earshot, "I'll be on a beach sipping some refreshing, cool beers." The subtext of this is, of course, that you'll be having a fab time while everyone else toils their fingers to the bone. But there's actually something travel-related we can all shout loudly and excitedly about: "This time next year," we can say, "we'll go abroad, and there will be no data roaming fees."

For many people, the fear of racking up a huge mobile data bill when sunning themselves abroad is up there with the worry of getting sunstroke or being bitten to death by mosquitos. It can certainly be expensive if you're not careful. In some parts of the world, you can pay in the region of £8 for every megabyte you consume and, given that a lot of people enjoy watching videos and looking at images on social media, that could have many crying into their wallets very quickly.

Scary stories crop up time and time again. A healthcare assistant in Turkey racked up a bill of £21,819 last year, and travellers to the Rio Olympics are being told that an average of 8MB of mobile data – which would get you a couple of minutes of streaming or 23 photo updates on Facebook – could end up costing as much as £40. The mobile industry and Ofcom refer to the look of horror as people realise how much they've spent as 'bill shock', and we can guess it causes a fair bit of cussing.

And yet despite all of that, uSwitch says only 18% of us check to see if there are cheaper roaming deals around, and 16% think using a mobile outside the European Union is actually free. So what's the

situation, and to what extent are roaming fees going to be axed? More to the point, how can we go away and relax knowing that we can do whatever we want with our mobile devices without the strain of worrying that the cost of checking Twitter each day is going to double the price of the trip?

First of all, things are not as clear cut as you may think. On 15th July 2017, roaming fees and the cost of making a phone call will indeed be the same as the price you pay at home, but since this is a European regulation, it will only apply to travel within the European Union. What's more, given that it's not a directive, the situation is actually up in the air as far as we're concerned here in the United Kingdom. The country's decision to leave the EU means the UK government will have to decide if it wants to follow the same path come 2019 when a Brexit is likely to be wrapped up. Those celebrations may be short lived.

Secondly, there are caps already in place for travel outside the EU. Mobile operators have a daily cut-off limit of around £40 regardless of where you are in the world, so the most you should pay if you go abroad and starting using your mobile data is in the region of £280 for the week. It's still a lot of money but nowhere near the thousands that many people could be stung by. And yet that limit doesn't apply to making calls, sending texts and retrieving voicemails, which is where the bills rack up.

Furthermore, those who do end up with the larger bills have opted out of the data cap, either having decided that they are too restrictive for their needs or simply without even knowing (see the boxout 'Watch Out For Add-ons'). It's a dangerous thing to opt out willingly unless you're rather carefree about your cash, but it does happen, primarily because the cap only allows for a small amount of usage. Those who want more, push for more, but as Ernest Doku, mobiles expert at uSwitch.com, says, "Never has there been more urgency for networks to improve rates for overseas mobile usage, particularly now

lower roaming prices inside the EU potentially hang in the balance following the UK's decision to leave.

Wi-fi Woes?

So what can you do? Well, there are ways of reducing your mobile data bills abroad, particularly outside the EU. The first thing to do if you want to ensure that you're not going to be getting any charges is to only activate roaming if and when you need it. You can turn roaming off in iOS by going to Settings > Mobile Data > Mobile Data Options and moving the Data Roaming switch to off. This will restrict all data to wi-fi. In Android, you can go to Wireless & Networks in Settings, select Mobile Networks, and burrow down to Data Roaming to do the same.

But even then, if you're only going to be making use of free wi-fi, whether in your hotel, a cafe or elsewhere in a city or resort, there are other things to watch out for. While you may be able to log on and

Mobile Data Rates		
These are the current rates for calls and mobile data if you're travelling within the EU today and how much they'll be next summer		
	Today	15/06/17
Outgoing voice calls (per minute)	Domestic price + up to €0.05	Domestic price
Incoming voice calls (per minute)	€0.0114	Domestic price
Outgoing texts (per SMS message)	Domestic price + up to €0.02	Domestic price
Online (data download, per MB)	Domestic price + up to €0.05	Domestic price

enjoy the delights of the web without 'bill shock', public wi-fi is not always the safest. The biggest risk is that the hotspots don't require authentication to connect to them, so hackers are able to access any devices that are unsecured. All they have to do is position themselves between your machine and the connection, and they may be able to intercept your information.

In a worst-case scenario, it can lead to malware being placed on your machine and for vital data such as logins to be divulged. So if you do think you'll be using wi-fi abroad, then it's worth getting yourself set up with a virtual private network (VPN) beforehand. Since the information will be encrypted so that the servers can't detect where you are, it presents much more of a hassle for the hackers and, as mean as it sounds, they'll just move on to someone else.

For an easy way to get a VPN, consider using the developer version of the Opera browser, which comes with one built in. There's also a free Opera VPN app available for iOS. Go to **goo.gl/A5FD9X** to find out more about this. If you don't go down this route, though, there are still ways to can make yourself secure: always use https websites and be very careful of the kind of sites you're visiting, for instance. It may be best to avoid banking or retail services completely and simply head for sites that don't require logins.

4G Or Not 4G?
But what if there isn't any wi-fi. or there is and you've now been scared off from using it? You could consider a service such as WifiVox (**www. wifivox.com**), which lets you rent your own wi-fi device. The package comes with the gadget itself, a wall-charger and a mini-USB cable, and

you get eight hours a day coverage between charges. It can be used on up to ten devices, and it's like having your own private wi-fi hotspot, albeit only in Spain where the company is based. Certainly if you're off on your jollies in dear Espana, this device means you don't have to go searching for a signal (it has a 15 metre range), and you get unlimited data too – perfect if you fancy a bit of streaming while you're chilling out (although bear in mind that it's 3G, so it may be slow; 4G is not yet fully developed in Spain).

To benefit from this, you do have to stump up, but thankfully it's not expensive, costing just 6.99 each day. Not that it's the only such service around: you may also want to consider signing up to My Webspot (**my-webspot.com**) instead, which gives you 4G and costs from 6.40 each day depending on where in Europe you're looking to go (it's typically 9.90 daily for unlimited internet). My Webspot covers

What Are Roaming Charges?
When you go abroad and make a call, send a text, listen to a voicemail message or access data, you incur a charge. In the EU, this is currently nominal, and it will be scrapped next year, but it can be large elsewhere. The charge is made because your phone is connecting to a third-party operator in a territory outside that of your own phone provider's. The third-party is asking for a fee for the service you're gaining, and this is added on to the domestic price of the call.

28 countries, has no hidden fees and works in the same logistical way as WifiVox, delivering a device to your hotel and asking you to send it back when you're finished with it.

A third option is Xcom Global (**www.xcomglobal.com**), which has a flat rate of $7.77 and works in 175 countries, including the United States, again offering 4G connections and being able to connect ten devices. These are brilliant ways to avoid any roaming fees, while still having a connection around wherever you go, meaning your data is more secure and you're not going to be breaking the bank in the process of simply trying to watch a video on YouTube or seeing what someone back home has had for dinner on Facebook.

If that seems too cumbersome, though, there are yet more options. You could check with your phone provider to see if there are any roaming add-ons you can benefit from. Tesco Mobile, for instance, has a promotion running until 3rd September, which is allowing customers to use data roam-free in 31 European countries (extending outside of the 28 members), while Vodafone goes further by including 40 countries. Three has its Feel at Home scheme, which includes the USA, Hong Kong and Australia, while O2 Travel has add-ons for non-EU travel. Exploring these options should save you a bundle.

You can also look to buy a SIM and sign up for a pay-as-you-go (PAYG) contract in the country you're visiting. That way, you know there won't be any roaming charges at all. While it does mean your number will be different to your normal one – so only those you hand it to will be able to call you – you'll suddenly be able to enjoy roughly similar rates to those you'd expect back home. Just make sure you look very carefully at the tariffs when making your choice, since PAYG costs do tend to be that bit higher than contracts, and ensure you also have an unlocked handset. The bonus of this method is that you'll be able to set your own caps by loading it up with cash before you use any data.

Compress To Impress

So are you ready for that break yet? Well, before you start packing, let's just look at one last thing: getting your data in shape. Just as you've been trying to get yourself trim for your hols, you can make sure there's no excess data flab too. For this, consider Onavo Extend, a service for the iPhone and iPad, which routes information coming to your device via a cloud-based compression service. By squeezing the data into a small form and then sending that to your Apple device, you end up using less data, helping to minimise roaming rates even further. It also turns itself off automatically whenever you're connected to wi-fi.

Another service by Onavo is Count, which is aimed at Android users. This looks at how much data you're using and whether or not you can cut it down – the idea being that good practice will reduce your data wastage in the long run. Meanwhile, Onavo Protect looks to throw an arm around your data when you go online, keeping your personal information secure and alerting you to possible threats. It's worth taking a look at each of these to see if they best suit your needs when you're going abroad.

Certainly, as you can see, there are ways to limit any surprises when you return from your travels. By remembering that data can be downloaded at standard rates without you even realising it (a big reason for turning it off), and keeping in mind that receiving calls and listening to voicemails outside of the EU isn't always advisable, you should be able to keep your cash safe. In every case, though, check your mobile bill for anything untoward, and immediately contact your phone provider if you feel something is amiss.

There are ways to complain to your mobile provider if you do find yourself saddled with a big bill, with CICAS or Ombudsman Services: Communications coming in handy as a last resort. But hopefully things won't get that far. With a bit of thought and the right equipment, you should be coming back from your hols nicely tanned and full of life. You certainly don't want to be saying, "This time last week, I had lots of money in my pocket," as you tug as the sides of your empty trousers. That really would put a dampener on things, wouldn't it? **mm**

Watch Out For Add-ons

The cap of £40 or so on roaming rates within Europe and of around £50 outside of the EU is a brilliant move, designed to prevent those eye-watering bills. But be careful. Although you can voluntarily opt out of the caps by making a phone call (but try to resist the urge not to), some roaming add-ons available from the networks may have a clause in the contract that opts you out without you knowing it. It's important to bear this in mind if you're looking to go down this path.

Cruising For A Bruising

Use your phone when you're at sea, whether on a ferry or a cruise, and it could cost you dearly. When you're out at sea, phones tend to look for a satellite connection rather than a mobile, and because data limits and EU tariffs don't apply, the resulting bill could be huge. You should either check with your provider to see where the land lies (groan!) or simply keep the phone off until you reach a destination.

No Man's Linux

Could the biggest game of the year be heading for Linux?
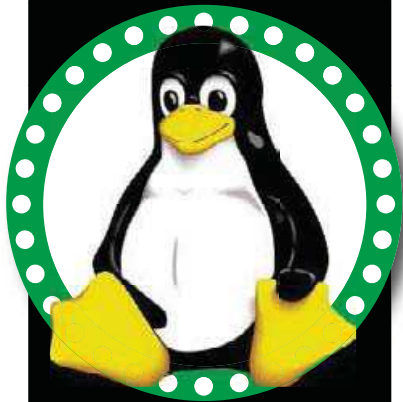
David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

There's little doubt that the anticipation surrounding the soon to be released *No Man's Sky* has reached fever pitch. Nearly every hour something relating to the game is released by game journalists, YouTubers and just about every online source available.

So far, in recent months at least, we've read about the delay, the death threats surrounding the delay announcement, the BSkyB legal threats, another possible lawsuit involving the environmental code used in the game, another possible delay for PC gamers and most recently the videos and news of someone buying a leaked copy of the game for PS4 via eBay.

However, one bit of good news that's being bandied about is the rumour that there could be a Linux or, more specifically, a SteamOS version of the game released in the not too distant future.

Infinite Linux
It's still only a rumour, so we really shouldn't be holding our breath until something a little more concrete is announced. But when you look at the minimum specs for the game: Core i3, 8GB RAM, Nvidia GTX 480 or equivalent OpenGL capable GPU, there's little wonder that the game will eventually find itself on our Linux systems.

There's also the history of Hello Games, where its last offering, *Joe Danger*, appeared on Windows, Mac and Linux PCs a few years ago. And the developer appears to be behind support for Linux.

Also, there's already a healthy Steam community discussion around the possibility of *No Man's Sky* for Linux (over 40 pages so far), so the developer would be missing out on a huge section of the potential gaming community if it decided to leave a Linux version out.

Citizens Of The Stars
Of course, the competition is on with regard to another sprawling space sim that's due to launch this year.

Star Citizen is looking to become the ultimate in space-based first-person multiplayer and, what's more, it's already developing a Linux version that will be launched at the same time as the Windows version, and there's even support for VR headsets from the go.

Naturally, we don't know how each game will fare in the months ahead. There are plenty of those for and against each title, and each is making itself known throughout the various forums and discussion posts.

The only thing we can do, as responsible gamers (Linux or otherwise), is get both games and play them to death, ignoring such day to day activities such as eating, sleeping or working, to see which of the two will come out tops.

As for Linux, *Star Citizen* may already have its nose over the finish line, so it'll be interesting to see what the developer of *No Man's Sky* has up its sleeves.

▼ *Will us Linux gamers ever be able to explore this universe?*

The Wrong Connections

Apple once obliterated proprietary ports, so why now about-face and return to such loathed territory?

I remember when the original iMac arrived and most of the tech industry went into meltdown. People recall that day as signalling the death of the floppy drive. Apple had removed that aging waste of space from its new computer, reasoning that we were living in the future, and people would now fling documents about via the internet. For loading software and the like, optical media was where it was at, not 3.5" disks.

There was plenty of wailing and gnashing of teeth, and quite a few companies made a lot of cash out of third-party Mac-compatible external floppy drives, making the gullible happy until they realised a year later they'd only used the thing once – and that was to check it worked.

What people forget is that the iMac was revolutionary in other areas too, and I'm not talking about in rapidly transforming an industry's industrial design to make semi-transparent colour plastic so terribly in vogue. (If I never again see standard beige PC towers with ill-advised green/blue organic bits glued on seemingly at random, it'll be too soon.) Where the iMac delivered another killer blow was in the area of ports.

Prior to the iMac, Mac users lived in a horror-filled world of proprietary accessories. Due to the platform's low market share, stores would hold stock accordingly: you'd peruse a massive range of kit for PCs, and then stare glumly at half a shelf of insanely expensive ADB (Apple Desktop Bus) devices. What people saw as arrogance in Apple dropping ADB entirely on the iMac was in reality one of the ballsiest and most aggressive moves in computing-input history. Apple went all-in on USB, and within a year ADB was gone from its entire product line.

Fortunately for Apple, the gamble paid off. The success of the iMac was such that companies clamoured to create compatible hardware. And because of the industry-standard nature of USB, the notion of the legacy-free PC became increasingly commonplace. Naturally, various companies still clung to their favourite mix of weird and wonderful proprietary and legacy ports, but they gradually gave way to the calming elegance of standardisation.

Today, though, Apple finds itself ushering in another upheaval regarding inputs. The super-skinny MacBook seems angry in being forced to have any inputs at all, merely offering a standard headphone jack and a sole USB-C port. Owners of external kit have resigned themselves to cumbersome hubs in order to connect older USB products, dreaming of the day when everything would go wireless and simultaneously actually work.

But over in iOS land, Apple is rumoured to be taking things even further, eradicating the headphone jack from the next iPhone. Instead, you'll use the Lightning port to connect headphones. (You can imagine Apple designers envisioning an iPhone in a couple of years time with no holes in the case at all.)

My take is this is a step too far. Previous bouts of Apple clobbering ports have been about elegance, streamlining and ubiquity, benefitting the industry and consumers alike. But it's hard to see removing the standard headphone port as a boost to anyone, bar Apple shareholders slavering at the thought of all the dongles Apple will sell. Right now, you can plug a pair of headphones into a PC, Mac, iPhone, iPad, iPod or any Android device where the manufacturer hasn't jumped the Apple gun and also dispensed with the port (in favour of USB-C). A future where you're restricted by platform or left juggling easily lost dongles isn't user-friendly, simpler and better. In short, it's not very Apple.

▼ *If you think Apple took paring back ports too far with the MacBook, the next iPhone might break you*

Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find **Craig** on Twitter at **@craiggrannell**

Mac

Smart Enough?

Ian McGurren spends a week with Apple's Smart Keyboard

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

The Apple Smart Keyboard isn't Apple's first iPad keyboard, and Apple is definitely no stranger to putting one together. Some of the most revered keyboards have found themselves on an Apple device, including the 2006 MacBooks, some of the first to use the now-familiar rounded, 'chiclet' or island-style keyboards. And it's this that is carried over into Apple's keyboards pretty much since then. The first-generation iPad keyboard, released with the original first-generation iPad, was essentially Apple's iMac keyboard with a 30-pin dock glued to it. While it gave users a very good keyboard to enter text with, that dock meant you could only use it with the iPad in portrait mode.

Fast forward a few years, and the tablet keyboard rulebook was rewritten, not by Apple, however, but by its rival, Microsoft. MS's long rumoured 'iPad-killer', Surface, was released in 2012 with a very clever accessory, the Type Cover. This was a keyboard that was also a cover – not a huge deal, as iPads had had that for some time. But here the cover was barely thicker than a regular Apple Smart Cover, but incorporated a near full-sized QWERTY keyboard. Here was the first keyboard that truly became invisible when not in use, but remained attached for when it was needed.

So with the release of a device that would count the Surface range as its rival, Apple needed to offer a keyboard that would be every bit as useful yet discreet as Microsoft's. Does the Smart Keyboard live up to that?

The Smart Keyboard's keyboard has some travel, but not enough to fool you that you're typing on a 'real' keyboard. The keys themselves feel okay, a little muted and a bit like an 80s computer such as the Philips Videopac, but you'd think they're independent of each other like a real keyboard, not all under the same covered surface.

The layout, certainly on the 12.9" version, is very well spaced, easy to type and even touch type on after a while, though the sensitivity of the keys means you'll have a few extra letters at first. But once settled in, it feels right, like a laptop keyboard. So much so in fact, I found myself reaching for a trackpad all too often. In lieu of a trackpad, there are some shortcuts, though other than Cmd+H (home button) and Cmd+space (Spotlight), they're app dependent, and it's mostly just Apple apps that have them.

There are a few other sources of irritation too. The main one is the lack of backlighting – something the rival Logitech Create does boast, though here there's no cost to the battery. The angle that the screen rests at is a bit too far back too, and it's all

you're getting. The Create has more angles, but it also doubles the weight of the iPad. There's also it's general clumsiness, be it opening it out into the keyboard (all too often mine would detach from the side) or the magnets not holding onto the rear of the iPad when it was at the rear, out of use. But despite this, when locked in place, it was very solid and could be carried without fear of it collapsing.

While the Smart Keyboard doesn't turn an iPad Pro into a laptop, it does make some of a laptop's core functions much easier and as productive, especially with iOS's split-screen multitasking. Some applications, such as Excel, still benefit from a mouse, and iOS has no mouse function, but for text-based applications, I'm finding the writing as easy as on a laptop. Saving, however, is still a pain in the proverbial.

So it is the best to get? If you want a keyboard for your iPad Pro, it's really between the Smart Keyboard and the Logitech Create. If you want a light but usable keyboard that is discreet, then it's got to be the Smart Keyboard. If you want a laptop experience, and to save 50%, it's the Logitech.

Mobile

Komplete Excitement

Native Instruments has updated its Komplete music production suite and added a cheaper bundle, writes Andrew Unsworth

This week, I'm writing about a hard disk. However, this isn't just any hard disk. It may behave like a regular hard disk, but this disk is emblazoned with the legend 'Komplete' and is set to be priced at £479 and £959 when it goes on sale on 1st September 2016. This price might seem a bit steep for a hard disk, but there's a good reason for that: it contains a compendium of Native Instruments' finest virtual instruments and effects. Indeed, Komplete is a good means of building a library of synths and sounds, whether you're a fledgling computer musician or a professional composer in need of the state of the art.

Traditionally, each version of Komplete has been available in two flavours: the standard edition and Ultimate, with only the Ultimate edition shipping on a hard disk. This time round, the standard version of Komplete will also be shipped on a hard disk. Komplete Select, a cheaper version of Komplete (£159, compared to £479 (standard) and £959 (Ultimate)), is another break with tradition, and it makes the Komplete ladder much more accessible to those who want high-quality soft-synths and instruments but who don't have the funds to buy the standard or Ultimate editions. Komplete Select is available on a USB flash drive if you buy the boxed version.

The use of a hard disk is due to the colossal amount of data of which Komplete is comprised. Not only do you have the data of each application in the Komplete bundle, you also have all the samples, loops and presets that those applications use.

As an example, the standard version of Komplete 11 has a sample library in excess of 155GB, so downloading the entire bundle would take a long time, especially if you have a poor internet connection.

Sounds Credible

Native Instruments produces some of the best software instruments on the market, and those included in Komplete are professional quality. The sample-based instruments are realistic, expressive and credible, while the soft-synths provide great scope for producing warped, outlandish sounds that'll add a uniqueness to your productions.

All editions include Massive, Monark, Reaktor Prism and Retro Machines 2, among other things. The standard and Ultimate editions also add Native Instruments' new Form soft-synth, which uses a sample as the catalyst for synthesis to let users create all manner for sounds. Also new is Una Corda, which is a piano instrument.

Although the instruments in the Komplete bundles will work with any MIDI controller and any DAW that supports VST and Audio Units plug-ins, they're also designed to make the most of the Kontrol S-series of MIDI keyboards (**tinyurl.com/jx3ed6u**). The Kontrol keyboards have extra controls that allow users to interact with the software instruments easily. There's no need to map the keyboards controls to the Komplete instruments' on-screen controls, for example. You can plug and play.

If you want to expand your virtual instrument collection or make the most of your MIDI keyboard, check out the Native Instruments website: **tinyurl.com/zmj8lgb**.
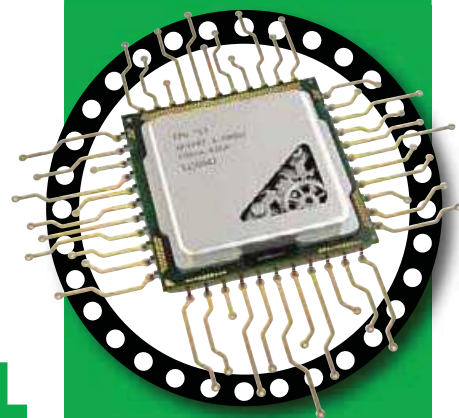
Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

Hardware

Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming

Into The Valley

It's a first-person shooter with a twist: you can bring things to life as well as blast things to death. Valley is out later this month, and looks highly promising

This week, Ryan takes a look at the unusual FPS Valley, and looks at the imminent release of the unofficial StarCraft II MMO StarCraft Universe...

Plug & Play

We're used to strapping on futuristic armour and killing things in videogames, but what about giving things life too? That's the unusual concept in *Valley*, a first-person shooter currently in the works at Blue Isle Studios. A mysterious alien artefact called the Lifeseed Relic has appeared somewhere in the Rockies and threatens to bring about an environmental disaster – and it's your job to strap into something called a L.E.A.F. suit and find out exactly what's going on. (L.E.A.F stands for Leap Effortlessly through Air Functionality, acronym fans.)

That suit is far more than your typical high-tech cladding; not only does it allow you to run super-fast and jump like a giant flea, but it also gives you the power over life and death. With a wave of your hand, you can take the life force from one creature or tree and use it to bring something dead back to life – *Valley*'s trailer (**youtu. be/L1O3DDvKHo0**) shows the player reviving an expired deer in a blaze of blue light,

and zapping energy back into a blackened, dead tree.

Elsewhere, there are all kinds of alien-looking enemies to blast and be blasted by, which brings us to the game's other twist. While your powers can have a positive effect on the world around you, dying requires you to drain energy from the environment in order to bring yourself back to life. It follows, then, that the more you die in *Valley*, the more devastated the landscape becomes.

Blue Isle Studios previously brought us the terrifying horror game *Slender: The Arrival*, so it's safe to say that *Valley* isn't all green pastures and gambolling deer; the game's brighter, above-world areas are contrasted by caves filled with enemies and some quite sinister-looking industrial areas full of weird glowing things.

In terms of mechanics, *Valley* vaguely recalls Raven Software's solid, largely overlooked 2010 shooter *Singularity*, where a special glove allowed you to manipulate time and do odd things like age an enemy

soldier until he turns into a skeleton. What we're hoping is that *Valley* offers more freedom to experiment than *Singularity* did, since it restricted its time-altering mechanic to specific objects and set-pieces. There's the possibility that *Valley*'s life-and-death idea is simply a gimmick – with reviving animals replacing the old task of placing crates on pressure-sensitive switches, say – but there's also the possibility that Blue Isle's game can do something far more ambitious and ground-breaking with it. If *Valley* is as good as it looks from the trailer, we could be in for a refreshingly different twist on the sci-fi games that appear to have inspired it. Could it be a kind of sandbox take on *Half-Life 2* or *BioShock* with an environmentalist theme? We'll have to wait and see.

Valley is scheduled to hit Steam on 24th August.

Online

Way, way back in the mists of time (that is, 2011), a group of modders embarked on an ambitious project: an MMO

▲ After five years and a bit of legal fuss and grief, Upheaval's StarCraft II MMORPG mod is almost with us

based on *StarCraft*. Taking *StarCraft II* and modding it into a sprawling RPG, *World Of StarCraft*, as it was then named, caused a ripple of excitement online – and also awoke the fury of Blizzard's lawyers. Within days, the modders responsible, specifically project lead Ryan Winzen, had received a cease-and-desist notice from the gaming behemoth, including orders to take down the making-of videos posted online showing off an early build of the sci-fi MMO.

For a moment, it looked as though *World Of StarCraft* would go the way of so many fan-made games based on established properties. But then Blizzard began to soften its stance when it revealed that its main beef wasn't with the game itself, but with the title, which it (understandably) deemed was too close to *World Of WarCraft*.

A quick name change later, and *StarCraft Universe* was off and running with Blizzard's blessing; the studio even

invited Winzen to visit its headquarters and meet the *StarCraft II* development team. Naturally, something as sprawling as a *StarCraft* MMO takes time and considerable resources, so Winzen and his tiny studio – by 2013 appropriately called Upheaval – took to Kickstarter. Its haul of $85,000 was modest by the standards of most crowdfunded games based on familiar names, but enough to keep development up and running.

Now, after over five years in production, *StarCraft Universe* has reached its open beta phase, which is open to those who backed its Kickstarter and also the current campaign on Indiegogo. The latter bout of crowdfunding, Upheaval says, is for *StarCraft Universe*'s post-release support, and the studio adds that the game will still be released regardless of how much it makes on that platform. Offering PvP battles, eight hero classes, crafting, buying and selling, *StarCraft Universe* looks like a promising

multiplayer twist on Blizzard's much-loved game. Sure, it might not be as polished and fully featured as an official Blizzard MMO, but given that the studio itself doesn't seem to be in a rush to make a massively multiplayer *StarCraft*, Upheaval's mod is a more than worthy stopgap. Best of all, it'll be free to play.

StarCraft Universe launches in late August.

Incoming

The Nintendo Wii will probably most broadly remembered for the console that shattered a thousand vases, but the system also boasted some genuinely great, imaginative games. One of those was *Little King's Story*, an action strategy game whose colourful, cartoony graphics belied a game with an unusually dark heart.

That *Little King's Story* hailed from Japan, was a Wii

exclusive and was generally drowned out by inferior shovelware meant that it could have vanished from history, but thankfully, Xseed Games is bringing this quirky cult gem to PC. And while it's true that there are already plenty of tactical RPGs available on Steam, there's enough charm, sly humour and sheer ingenuity in *Little King's Story* to make it worth recommending to all but the most hardcore of strategy buffs. If you've ever played *Overlord*, you'll get the drop of *Little King's Story* right away: you control the youthful monarch of the title, who's followed into battle by an army of minions with varied abilities. By winning battles and earning gold, the little king gradually expands his empire, revealing more about the game's curious, anime world in the process.

Little King's Story is available on Steam now. **mm**

▲ A cult gem from the Nintendo Wii is now available on PC. Never mind the cute graphics: *Little King's Story* is a tactical RPG with a seriously dark thread of humour

AD INDEX

To advertise contact :

Karl Taylor: +44 (0)20 7907 96706
Karl_Taylor@dennis.co.uk

NOTE TO ADVERTISERS

FREE Private Classified Adverts

1 **EMAIL**
Send your short adverts (see below) to MicroMartClassifiedAdverts@gmail.com
Your advert will then magically appear in the magazine, courtesy of our team of trained elves

2 **POST**
Fill in the form below and post it to:
Micro Mart, Dennis Publishing, 30 Cleveland Street, London, W1T 4JD   ◀ **NEW ADDRESS!**

Step 1

Write the wording for your advert in the numbered boxes below (one word each box). Maximum 30 words free.
Please complete in BLOCK CAPITAL LETTERS, then proceed to Step 2

					30 Words FREE Private Ads Only Trade ads MUST be boxed or reversed	Boxed		Reversed	
						Private	Trade	Private	Trade
1	2	3	4	5					
6	7	8	9	10		£6.80	£13.60	£8.00	£16.00
11	12	13	14	15					
16	17	18	19	20					
21	22	23	24	25					
26	27	28	29	30					
31	32	33	34	35	£1.70	£8.50	£17.00	£9.70	£19.40
36	37	38	39	40	£3.40	£10.20	£20.40	£11.40	£22.80
41	42	43	44	45	£5.10	£11.90	£23.80	£13.10	£26.20
46	47	48	49	50	£6.80	£13.60	£27.20	£14.80	£29.60
51	52	53	54	55	£8.50	£15.30	£30.60	£16.50	£33.00
56	57	58	59	60	£10.20	£17.00	£34.00	£18.20	£36.40

Step 2

Choose a category you would like your advert to appear in and tick the box.

☐ **Hardware for sale**   ☐ **Software for sale**   ☐ **General for sale**   ☐ **Accessories**
☐ **Hardware wanted**   ☐ **Software wanted**   ☐ **General wanted**

Step 3

Complete all fields of your personal details and payment method.

Name

Address

Post Code

Landline Telephone No.   Email

Please tick appropriately   ☐ **Private**   ☐ **Trade**
I enclose payment by   ☐ **Cheque**   ☐ **Postal order**
or please Debit my Mastercard/Visa/Amex account No

Expiry Date:

Authorise payment for £

THE **COACH** EFFECT

FREE! HEALTH / FITNESS / ACTIVITY / MOTIVATION / REWARD

COACH

DO SOMETHING

The new health & fitness magazine

FREE EVERY WEDNESDAY

Find out where at coachmag.co.uk

FITTER+HEALTHIER+HAPPIER

#COACHEFFECT

HARDWARE FOR SALE

Have you got old kit lying around? Fancy making a few pounds while you're at it? Why not advertise here? It's easy and it's free, just email what you've got, how much you'd like for it, and your contact details to micromartclassifieds@ gmail.com, and we'll do the rest. There are thousands of enthusiastic readers out there looking for components every week, and you may have something unwanted they've been searching for, so get in touch and save your kit from going to the tip!

Socket 939 CPUs AMD I got about for of these of different speeds all tested and working. Please let me know what kind of speed you are looking for I will try and match up as close as possible. Please email or call me for a price.
Tel: David (01616) 888119
Email:pcmadnessltd@yahoo.co.uk

Seagate hybrid 500Gb laptop hard drive mounted in Bipra ext. enclosure for 2.5" SATA *HDD. £26 plus £4 p&p.*
Email: k_nathan@talktalk.net

Laptop DDR2 RAM different sizes just ask what you want and i will let you know if i have it pulled from a working laptops this is the quickest way to boost you laptop speed please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3.33Ghz intel 64 bit CPU 1gb Ram (max4gb) 3pci agp 2IDE 2SATA 8usb ports LAN sound. Great for gaming, office work, surfing, watching movies generally a good all-round system. Spec can be changed if required. Please email or call me for price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Windows XP Pro Computers Fresh install of Windows XP Pro this Computer great for gaming, office work, surfing the net, watching movies generally a good all round system from £100 +p&p.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Retro Win98se Computers Fresh install of Windows 98SE. This computer is ideal for running legacy programs and for playing older "memory lane" games as well as for car garage or industrial use as heavy duty and has serial parallel ports. From £50 +p&p Might also have laptops price on request please email or call me for more information.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Brand new USB brackets add 2 extra USB2 ports to your computer at little cost and very simple to fit cable connect onto the motherboard and uses a spare slot on the back of your computer no drivers required please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Windows 7 Computers Fresh install of Windows 7 this Computer great for gaming, office work, surfing the net, watching movies generally a good all round system from £150 +p&p might also have laptops price on request please email or call me for more information.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3Ghz AMD 64bit CPU 512MB Ram 5xpci 2xSATA 2IDE 1Gb LAN 6 channel sound firewire COMES WITH DRIVER CD AND MANUAL great for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required £35 + p&p please email or call for info.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

PC gaming hardware I have got 1x force feedback steering wheel 1x force feedback joystick 1x normal joystick lots of game pads please email or call me for a price.
Tel: David (01616) 888119
Email:pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3.2Ghz Intel 64 bit CPU 1GB Ram 2pci-e 2xpci 2IDE 2SATA 8usb ports LAN 6ch sound COMES WITH DRIVER CD AND MANUAL Great for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required please email or call me for a price
Tel: David (01616) 888119
Email:pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3.5+Ghz AMD 64 bit CPU 1gb Ram (max8gb) 2pci-e 4pci 2IDE 3SATA+ 1eSATA 8usb ports LAN sound Great for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required. Email or call for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 2.4Ghz AMD Athlon XP 32bit CPU 512MB Ram 5xpci 2IDE LAN sound good for gaming, office work, surfing the net, watching movies generally a good all round system spec can be changed if required please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Sony Vaio VGN-TT21 11.1" Laptop, docking station complete with two Sony power supplies and Vaio embossed grey semi-hard travel case running fresh Windows 7 Pro install. Excellent condition. Ultralight and portable. Very high spec:- 4GB DDR3 memory, 128GB Samsung SSD Solid State hard disc, Core 2 Duo 1.2 GHz Intel processor, built-in DVD drive, a/b/g/n Wireless, WWAN, Gigabit Ethernet LAN, Bluetooth, HDMI out, fingerprint sensor etc. For full spec and details please call. £300.00. Collect from Banbury or RM insured Special Delivery **£11.**
Tel: David (01295) 253554
or 07899792036

Internal 3 1/4 floppy drives choice of white/black/silver/no face plate please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

WIFI wireless PCMCIA card for older laptops to enable them to connect to wireless networks £10 +p&p if interested please email me.
Tel: David (01616) 888119
Email:pcmadnessltd@yahoo.co.uk

Laptop CPUs mainly Intel different speeds please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Fans different sizes and types please email or call me for a price.
Tel: David (01616) 888119
Email:pcmadnessltd@yahoo.co.uk

Brand new Laptop bag still sealed in the plastic bag and never used (it came as part of a bundle) please email or call me for a price.
Tel: David (01616) 888119
Email:pcmadnessltd@yahoo.co.uk

Socket 370 CPUs Intel. I got lots of these of different speeds, all tested and working. Please let me know what kind of speed you are looking for I will try and match up as close as possible. Please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

ATX PSUs. I got lots of these of different types and wattage, all tested and working. Please let me know what you are looking for I will try and match up as close as possible. Email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Sound cards. I got lots of these of PCI and ISA types all tested and working. Please let me know whatyou are looking for I will try and match up as close as possible. Please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

LAN network cards. I got lots of these of PCI and ISA types wired and wireless, all tested and working. Please let me know what you are looking for I will try and match up as close as possible. Please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

PCI GFX VGA cards. I got lots of these of different brands all tested and working. Please let me know what you are looking for I will try and match up as close as possible. Please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Desktop DDR2 RAM. Different sizes and speeds just ask what you want and I will let you know if I have it pulled from a working laptop. This is the quickest way to boost your laptop speed. Please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Any distro version 64 or 32bit Linux CD/DVD £12.50 inc postage. Email or call for info
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Laptops different specs please let me know what you are looking for or what you will be using it for and I will let you know what I have please email or call me for information.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Asus Sabertooth X79 Motherboard with socket 2011 Intel i7-4820K 3.70ghz processor and 32GB Corsair memory, manual, driver CD, cables. £300 plus postage. Email for pictures.
Tel: Ken (01502) 500724
Email: kenmardell@hotmail.com

Motherboard Bundle 2.8Ghz Intel 64 bit CPU 1gb RAM (max4gb) 2pci-e 2pci 1IDE 4SATA 8usb ports LAN 6ch sound. Great for gaming, work, surfing the internet, watching movies. A good allround specification can slightly be changed if required please email or call me for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3.33GHz Intel 64-bit CPU 1GB RAM (max 4GB) 3pci agp 2IDE 2SATA 8usb ports LAN sound. Great for gaming, office work, surfing, watching movies generally a good all-round system. Spec can slightly be changed if required. Email or call for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Laptop DDR2 RAM different sizes just ask what you want and I will let you know if I have it pulled from a working laptops this is the quickest way to boost you laptop speed please email or call me for a price.
Tel: David (01616) 888119 Email: pcmadnessltd@yahoo.co.uk

160GB 3 1/2 inch desktop hard drive IDE and SATA clean pull (little to no use) no bad sectors tested all you need to do is plug in and go. £20 +p&p. Please email or call me for more information.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

SDRAM SIMM DIMM DDR DDR2 DDR3 call or email me for the RAM your require
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Desktop cases. AT and ATX types and tower and flatbed form factor different sizes and colours can be posted or picked up from Manchester please email or call me with your requirements for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle. 2.8Ghz Intel 32bit CPU 512MB Ram 3xpci 2xSATA 2IDE LAN sound good for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

AGP graphics cards. Also PCI and PCI-e. Email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Cisco 4Mb Router Flash Card £10
Tel: Gary (01415) 712822 or (07941) 486760
Email: gary.gemmell@ntlworld.com

PC gaming hardware. I have got 1x force feedback steering wheel 1x force feedback joystick 1x normal joystick lots of game pads please email or call for a price.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Internal 3 1/4 floppy drives. Choice of white/black/silver/no face plate please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Ergotron LX Dual Side-by-Side LCD Monitor Arm Model: 45-245-026. Create a fully adjustable side-by-side monitor configuration, suitable for screens up to 24"
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

PS/2 Keyboard These are standard keyboards please email or call me for more information
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Laptops. Different specs please let me know what you are looking for or what you will be using it for and I will let you know what I have. Please email or call me for info.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

AT Keyboard These are standard keyboards please email or call me for more information
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Zalman Z11 SSD 3.5 Inch To 5.25 Inch Converter Tray £5 inc p&p.
Tel: Gary (01415) 712822 or (07941) 486760
Email: gary.gemmell@ntlworld.com

Minolta Dimage Scan Dual 35mm film/negative scanner with AP10 APS cassette adaptor. 2438 DPI. SCSI 2 interface. Working. Complete with original software, instructions and cables. £15.
Tel: (02084) 497724
Email: murray.ailes@sky.com

Adaptec 2100S Scsi Raid Card With 128mb Ecc Cache Ram Memory Module - £15.
Tel: Gary (01415) 712822 or (07941) 486760
Email: gary.gemmell@ntlworld.com

Dlink Airplus G+ Wireless Pci Network Card £15.
Tel: Gary (01415) 712822 or *(07941) 486760*
Email: gary.gemmell@ntlworld.com

HP PO2015 Laserjet Extra Lower Printer Tray £20.
Tel: Gary (01415) 712822 or (07941) 486760
Email: gary.gemmell@ntlworld.com

Desktop Digital Psu Tester. £10.
Tel: Gary (01415) 712822 or (07941) 486760
Email: gary.gemmell@ntlworld.com

Coolermaster Centurion 5 midtower case. Excellent condition. All front and back blanking plates present. Can be supplied with coolermaster 650W PSU £15 extra. £15.00 +p&p or collect from Bradford WY
Tel: David (01274) 610045
mail: dgaguine@gmail.com

Intel Wireless PCI-E Laptop Network Card. £10.
Tel: Gary (01415) 712822 or (07941) 486760
Email: gary.gemmell@ntlworld.com

Any distro version 64bit or 32 bit Linux CD/DVD. £12.50 inc postage. Please email or call me for info.
Tel: David (01616) 888119 Email: pcmadnessltd@yahoo.co.uk

WI-FI wireless pcmcia card will fit in older laptops to enable them to connect to wireless networks £10 +p&p if intrested please email me
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3.2Ghz Intel 64 bit CPU 1GB Ram 2pci-e 2x PCI 2IDE 2SATA 8usb ports LAN 6ch sound COMES WITH DRIVER CD AND MANUAL Great for gaming, office work, surfing or watching movies. Generally a good all round system spec that can slightly be changed if required please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3.5+Ghz AMD 64 bit CPU 1GB Ram (max8gb) 2pci-e 4pci 2IDE 3SATA+ 1eSATA 8usb ports LAN sound Great for gaming, office work, surfing, watching movies generally a good all round system spec can slightly be changed if required. Email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 3Ghz AMD 64bit CPU 512MB Ram 5xpci 2xSATA 2IDE 1Gb LAN 6 channel sound firewire COMES WITH DRIVER CD AND MANUAL great for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required £35 + p&p please email or call for info
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Windows XP pro Computers Fresh install of Win XP Pro, this Computer great for gaming, office work, surfing, watching movies generally a good all round system from £100 +p&p might also have laptops price on request please email or call me for more information
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Windows 7 Computers Fresh install of Windows 7 this Computer great for gaming, office work, surfing the net, watching movies generally a good all round system from £150 +p&p might also have laptops price on request please email or call me for info.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Brand new Laptop bag still sealed in the plastic bag and never used (it came as part of a bundle) please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Sapphire ATi Radeon HD3850 512MB 256Bit GDDR3 AGP 8x DUAL DVI/HDTV Graphics Card to of the range AGP GFX card i beleve it supports DirectX 10 great for gaming, watching movies, video editing, CAD/CAM applications and any other hight demand gfx programs generally a good all rounder £80 +p&p please email or call me for more info
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

2.1 speakers with sub woofer slight buzzing £25
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Internal 3 1/4 floppy drives choice of white/black/silver/no face plate please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

WI-FI wireless pcmcia card will fit in older laptops to enable them to connect to wireless networks £10 +p&p if intrested please email me
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Brand new Laptop bag still sealed in the plastic bag and never used (it came as part of a bundle) please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

160GB 3½" desktop hard drive. IDE and SATA clean pull (little to no use) no bad sectors tested all you need to do is plug in. £20 +p&p please email or call for more info.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Laptop RAM 2x1GB PC3-8500 DDR3 1067MHz pulled form a working Macbook pro but can be used in other laptops. The quickest way to boost you laptop speed please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Laptop CPUs mainly intel different speeds please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Retro Win98se Computers Fresh install of Windows 98SE ideal for running legacy programs and for playing older "memory lane" games as well as for car garage or industrial use as heavy duty and has serial parallel ports. from £50 +p&p might also have laptops price on request please email or call me for more information
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Different types of ram SDRAM SIMM DIMM DDR DDR2 DDR3 call or email me requirements
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

AGP graphics cards also PCI and PCI-e graphics cards please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

PS/2 Keyboard. These are standard keyboards please email or call me for more information
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 2.8GHz Intel 32bit CPU 512MB Ram 3x pci 2xSATA 2IDE LAN, sound good for gaming, office work, surfing, movies. Generally a good all round system specm can be changed if required please email or call me for prices.
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Motherboard Bundle 2.4Ghz AMD Athlon XP 32bit CPU 512MB Ram 5xpci 2IDE LAN sound good for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

PC gaming hardware. I have 1x force feedback steering wheel 1x force feedback joystick 1x normal joystick lots of game pads please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

Fans different sizes and types please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

AMD PHENOM 905E. Socket AM3CPU in perfect working order and cosmetic condition. 65W TDP, so it runs cool. 2.5ghz. 6mb cache. Bare chip only. Will send recorded delivery.£43 inc. postage.
Tel: (02088) 899344
Email: hh872@myopen.ac.uk

As New/Unused PCCHIPS M811LU R3.1. Box scruffy but contents are new/unused. Contents Motherboard/cableset/ backplate/cd driver disk. 7 day warranty. Socket A/462. £25 including recorded delivery.
Tel: (02088) 899344
Email: hh872@myopen.ac.uk

SSD 120 GB. Sandisk Plus Solid state hard drive. SATA 3 – 6GB/s. Perfect. Very fast drive. Only two months old and never used. Free delivery. PayPal accepted. £36.
Email: geofry@tiscali.co.uk

RADIOACTIVE FAIR - Civic Hall, Nantwich, Cheshire, CW55DG. Sunday 14th Feb 2016. Computers, Electronics, Ham Radio. ~100 Traders, Catering, Free Parking. Sun 14 Feb. Trade enquiries, Roger Reeves
Tel: (07747) 618131
Web: www.radioactivefair.co.uk

Like new hardly used Mac Mini. 2014, w/ upgraded storage to 128GB SSD. i5 3rd generation and 4GB RAM, Optional Bluetooth keyboard. £360 text/email.
Tel: (07950) 298812
Email: ghzrepairs@gmail.com

20" HP LP2065 LCD monitor. High res 1200 x 1600. Couple of USB 2.0 ports, ideal for connecting a mouse and keyboard.

Also has 2x DVI ports. One dead pixel in upper left corner. Hardly noticeable. No other defects. Perfect upgrade from older 17 or 19" model. Just £40!
Tel: Ian Matthew (01132) 629028
Email: ianmatthewuk@yahoo.co.uk

Floppy Disk Drives white black silver all working £10 +p&p please email or call me for more information
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

PCI GFX VGA cards I got lots of these of different brands all tested and working please let me know what you are looking for I will try and match up as close as possible please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

NVIDIA AGP 128MB Graphics Video Card; model number P162 £3 plus postage. (untested)
Email: paulvwells@gmail.com
Sound cards i got lots of these of PCI and ISA types all tested and working please let me know what you are looking for i will try and match up as close as possible please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

35x Ram modules: mostly Kingston 133x64cs 258mb (168 pin) and a few 128mb and 512mb modules as well. Only £30 inc pp so less than £1 per module! (untested)
Email: paulvwells@gmail.com

LAN network cards. Various PCI and ISA types wired and wireless all tested and working please let me know what you are looking for I will try and match up as close as possible please email or call me for a price
Tel: David (01616) 888119
Email: pcmadnessltd@yahoo.co.uk

HP Compaq NX7010 Laptop. Very good all round condition. Comes with a new charger. 60gb H.D. 2 G.B. Ram. £60.00 o.v.n.o.
Tel: (01726) 61355
Email: arcanu@tiscali.co.uk

HARDWARE WANTED

Trying to breathe life back into an old machine? Why not submit a wanted ad to MicroMartClassifiedAdverts@gmail.com and see if any of the thousands of computer enthusiasts who read the magazine each week have what you're looking for?

WANTED: Tape drive backup. Either DAT320 or later generation LTO system in good condition. Please contact me.
Tel: (07949) 407022 Email: tape.20. odaily@spamgourmet.com

WANTED: You bought a Corsair water cooler, with a square block. You fitted it to your Intel processor. You want to make a few pounds from the spare A.M.D. bits? Contact me!
Email: johnrpeel@gmail.com

WANTED: Gigabyte GA-Z77X-D3H motherboard wanted.
Email: johnbeiry@gmail.com

WANTED: PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.
Tel: Bill (07742) 061569 or (02641) 769503.

SOFTWARE FOR SALE

Sim City 2000: Boxed and original. Classic gaming. £15.00
Tel: Gordon (01314) 660205 Email: scobieg09@gmail.com

Adobe Photoshop Elements and Premiere Elements 12 Full Version - Windows/Mac. Original Boxed CD with unused product key. £47.50
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

PCB design software. 127 layers, schematic entry, PCB entry, PCB to Gerber file converter, output to printer. £9.99
Tel: Nigel Wright (07967) 527693
Email: cresswellavenue@talktalk.net

Microsoft Office 2013. Original Software only £100.
Tel: Gordon (01314) 660205
E-mail: scobieg09@gmail.com

Cyberlink PowerDVD 12 Standard. Runs under Windows 8, 7, Vista or XP. Original CD with unused product key £7.50
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Nuance Omnipage 18. OCR; Windows 8, 7, Vista or XP, Original CD with unused product key £25.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Acronis True Image Home 2012. Bootable CD. Application runs under Windows 8, 7, Vista or XP. Original Acronis CD with unused product key £5.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

SOFTWARE WANTED

Good Text to Speech program WinXP or 7 to read ebooks aloud for a pensioner with few resources. *Tel: Wilf James (01767) 699809*

Wanted: PictureToExe software, for making picture shows.
Tel: (01202) 610602
Email: ivor.mary@talktalk.net

Wanted: Quicken 2001. I desperately require a copy of QUICKEN 2001, UK Edition. I need to reinstall the program, but have lost my original installation CD.
Email: david.maddams@icloud.com

To place an ad, simply fill in the form on page 99 and mail it in, or email the details to:
MicroMartClassifiedAdverts@gmail.com

ASK AARON

Back In Black

Would you like to comment on this minor but irritating problem? My Windows 7 Pro boots into a desktop where the icons are overlaid with black rectangles. I have to restore my icons by running the following batch file.

```
set iconcache=%localappdata%\IconCache.db
If exist "%iconcache%" goto delID
echo Icon DB has already been deleted.
pause
exit /B

:delID
echo.
ie4uinit.exe -ClearIconCache
taskkill /IM explorer.exe /F
del "%iconcache%" /A
del "%localappdata%\Microsoft\Windows\Explorer\
iconcache*" /A
start explorer.exe
exit /B
```

However, this solution doesn't stick, and the .bat has to be run at every boot. None of the forums seem to be able to help. There's no iconcache file in my \AppData\Local folder.

Jim

The problem you're having does seem to be tied to the iconcache, and the fact your batch file fixes it would confirm this, as the code is basically stopping Explorer deleting the iconcache and then restarting Explorer. At least, that's how it looks.

I'd be interested to see what would happen to your desktop if you simply stopped Explorer and then restarted it without any other actions. I suspect this may solve the problem. Also, have you simply tried pressing F5 to refresh the screen? I'm sure you have, but if not, I'd give it a go.

Alternatively, if the problem is more deeply rooted and does lie with the iconcache, you may be having problems as you're not actually ending the Explorer process properly, but with force. Instead, I'd suggest you try opening Task Manager and going into processes. Locate the Explorer process and choose to end it there. Then, try running the following code in a batch file or via the command line.

```
CD /d %userprofile%\AppData\Local
DEL IconCache.db /a
```

Once it's run, start explorer again, via the Task Manager and reboot the system. Hopefully, your icons will be okay.

If the problem persists, you could make the problem easier to deal with by simply adding the code I provided or your original code as a batch file placed within Windows' startup folder. This would mean the script is run automatically when Windows boots and could take the manual effort out of it.

Another trick that could work would be to reset the thumbnail cache. To do this, open the Disk Cleanup window and look through the list for Thumbnails. Tick it, and click OK. When prompted, press the Delete Files button.

Next, here's another bit of batch file coding that may help. Reproduce this into your own batch file.

```
echo.
taskkill /f /im explorer.exe
timeout 2 /nobreak>nul
echo.

DEL /F /S /Q /A %LocalAppData%\Microsoft\
Windows\Explorer\thumbcache_*.db

timeout 2 /nobreak>nul
start explorer.exe
echo.
Pause
```

This will, like your own file, terminate Explorer, so ensure you save and close all work before you run it. Once this has run, see if the desktop looks good and also try rebooting your PC.

Alongside this, I'd also advise you double-check your display drivers, just in case, as outdated or corrupted drivers could cause this kind of thing, and it's an easy fix that may save a lot of messing around. Further, when in Explorer, go into Folder options and try ticking the option to 'Always show icons, never thumbnails' or un-tick it if it's already ticked. The opposite option could be helpful for you.

Hopefully, one of these tips will work, and you'll be able to banish the black boxes from your desktop. Good luck!

◄ *Black icons are likely an explorer cache problem, including icon and thumbnail cache*

Undetectable

I have just upgraded my PC from Windows XP to Windows 8.1 64-bit and then to Windows 10. When I put a disc in the DVD drive Windows fails to recognise it and asks me to 'Insert disc'. I gather this is a not infrequent problem with Windows 10, but have not found a solution online that works. Can you help me?

Dave

My initial advice here would be to double-check your drivers. Usually, Windows really doesn't need any drivers and will utilise optical drives with built-in software. However, if there's been some confusion in terms of drivers or out-of-date versions, Windows could struggle to actually recognise the type of optical drive, confusing it with another breed, such as thinking a DVD drive is a CD-ROM drive.

The first step here would be to simply uninstall the drive in Device Manager, and then reboot and let Windows detect it itself. Hopefully, any confusion over the drive that occurred during the upgrade process will be ironed out.

Failing that, I'd suggest you check that your system's chipset drivers are up to date and fully certified for Windows 10, as older drivers not suitable for the new OS may well cause problems of this type.

Next, we'll take a look at the Windows registry, as you could have some corrupt entries here. Open the Registry Editor by pressing WIN+R and typing 'regedit', then press Enter. Navigate to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Class\{4D36E965-E325-11CE-BFC1-08002BE10318}, and in the right-hand pane highlight UpperFilters. Click Edit and delete this. Now select LowerFilters and delete this too. Finally, close the Registry Editor and reboot your system.

If this doesn't solve the problem, we can try adding a new registry key that may rectify the problem. So once again open the Registry Editor, and this time, navigate to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\atapi. Right-click 'atapi' and select New > Key.

Give the key the name 'Controller0' and then right-click it and select New and choose DWORD(32-bit) Value. Name this value EnumDevice1 and press Return. Now, right-click this new value and click Modify. In the Value Data box enter '1' and click OK. Close the Registry Editor and reboot your PC.

One of these solutions should solve the problem for yo. Hopefully, once you reboot, you'll be able to use the drive properly once again.

▼ *If Windows 10 won't recognise your optical drive, a registry fix could be needed*
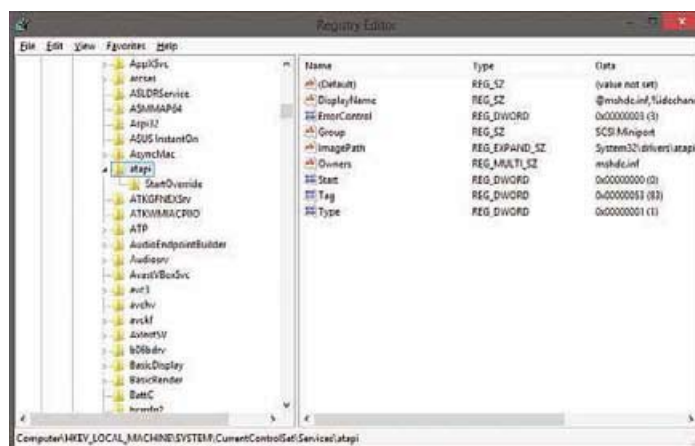
Too Late For Windows 10?

Well, it happened. I held off for far too long, and I've been told that I'm no longer able to upgrade my copy of Windows to Windows 10 for free. At least, that's what a friend told me. I held off for a long time as I was just happy with Windows 8 and thought I'd have plenty of time to decide.

Is this correct? Am I now out of luck if I want to go to Windows 10 for free?

Chris

Sadly, this is correct. Microsoft issued a warning about the end date, which was July 29th 2016. If you now attempt to use the GWX service to upgrade, you'll simply be told the free offer has now expired. It's worth noting, however, that users who make use of 'assistive technologies' may be exempt from this and could still qualify for a free upgrade. The vast majority of us, however, are no longer able to upgrade without purchasing the new OS.

Some have speculated that some new upgrade offers may surface in the future, but there's no official information on this,

▲ *If you've not upgrade to Windows 10 by now, you'll have to pay for the OS*

and it's doubtful that any more free upgrades will be offered anytime in the near future.

Buy Cheap, Buy Once?

The free upgrade to Windows 10 is now over – at least officially, though I'm aware there are numerous workarounds – but I've been tasked with upgrading half a dozen machines owned by a local charity (they're currently on Windows 7). On eBay, I see it's possible to buy Windows 10 licence keys for under a tenner. Apparently these are legitimate, always activate, never have trouble with updates, and so on. What's the catch? Am I likely to get burned?

David, Gmail

I've mentioned these cheap Windows 10 keys before, and I confess I'm still unsure how they exist. I reckon one way to bag a shed-load of keys would be to take a Windows 7 or 8.x PC, upgrade it to Windows 10, retrieve the key, change some aspect of the PC's hardware (a different CPU or more or less RAM, say), then do the whole thing again. A fresh key each time. Rinse and repeat across maybe half a dozen PCs, and 100 keys a week could be generated easily.

Now, a Windows 10 key is supposed to be tied to the PC used for the upgrade, but what if that PC were taken offline before activation? Also, what if Microsoft is being soft on enforcement, merely ensuring a key is genuine and nothing more? That would certainly be effective in swelling Windows 10's user-base and getting people off Windows 7 and 8.x. Of course, a Windows 7 or 8.x key is meant to be good for only a single upgrade, but maybe Microsoft's letting this slide, too?

Another possibility, Dave, is that these £10 keys have leaked out of the Microsoft Developer Network (MSDN). Keys for previous versions of Windows have been sold this way, and sooner or later Microsoft has blacklisted them, deactivating the Windows installations using them. That could happen with these cheap Windows 10 keys, regardless of how they've been generated.

Having said that, eBay's red hot with its Verified Rights Owner programme (VeRO). Dodgy software doesn't last five minutes, yet some of the listings for £10 keys have been live on there for months. Most sellers have 100% positive feedback, too. You'd suspect that, If the

> ## " eBay's red hot with its Verified Rights Owner programme "

keys were susceptible to failure, some buyers would have left nasty comments by now? Maybe the keys are totally legit and I simply can't figure out how it's possible.

Would I buy one? Certainly. I know it's the charity's money you're playing with (is there a reason for not sticking with Windows 7?), and £60 for half a dozen keys is a sizable chunk from what's no doubt a non-existent budget, but I think the odds of success are stacked in your favour. All the signs are good.

Or maybe you could explore those workarounds and still upgrade to Windows 10 for free...

▼ *Should you risk it?*

One Size Fits All?

I've been sorting out my attic and have come across a pile of hard drives and floppy disks. I've not much idea what's on them – I guess I must have kept them for a reason – but before throwing them out, I'd like to back up anything of value. Some of the drives are fairly modern (a 200GB SATA unit, for instance), whilst others are ancient (one's a 120MB IDE unit – yes, megabytes, not gigabytes!). Some are 2.5"; some are 3.5".

To save a lot of messing about with cables and caddies, what I'm after is a USB device I can slot these drives into. I can find ones for SATA or IDE but not both, and ones for 2.5" or 3.5" but, again, not both. Do you know of a device that does the whole lot? One with a built-in floppy reader would be nice...

H. Collins, Greater Manchester

*Cast your eyes over this eBay link: **goo.gl/Nvp3lj**. It's a £13 box with two top-loading slots, one for ATA/IDE and one for SATA. The slots will accept either 2.5" or 3.5" drives, and, I believe, if two drives are fitted at once, data can be transferred between them (via a PC, not directly). There's even a multi-format card reader on the front. Sadly, optical drives aren't a goer – they won't fit in the slots.*

The box looks typically cheap-and-cheerful, and of typically Chinese origin, and I doubt

it's up to much in terms of robusticity (a much nicer word than 'robustness', don't you think?), but I imagine it'll serve your purpose well enough. I should mention that I've not used or even seen one, though. The device I've linked to is the USB 2.0 model; there's a USB 3.0 model for a few quid more if you think the extra speed would be worth it.

*I'm surprised Sharkoon doesn't make something similar – it seems to make every other sort of enclosure – but it does make the DriveLink. This is a lump of plastic with ATA/IDE and SATA interfaces mounted around the edges, and it'll handle all of the drives supported by the generic box mentioned above and also optical drives (except laptop-style jobs). See here (Sharkoon's website): **goo.gl/auSPIu**.*

Trouble is, the USB 2.0 model costs nearly £30; the USB 3.0 model costs nearly £45. Jeepers! There are Chinese clones at a fraction of that, but I bought one once and it fell to pieces after I glared at it for not working.

As for accessing those floppies, I haven't found an all-in-one device that'll help with that. I guess the potential market is minuscule by this point. You'll need a separate USB floppy drive, I'm afraid. Just bang 'USB floppy' into the search bar of your favourite computing emporium and you should see suitable items from around £7. Or second-

hand models often sell for peanuts on eBay. Good luck! I hope you manage to retrieve some interesting data.

Note – I believe the USB 2.0 DriveLink supports only SATA I (the controller is JMicron's JM20337), and even the USB 3.0 version seems to go up to only SATA II (the controller there being Innostor's IS611). It's probably the same story for most if not all generic devices. Transfer speeds across SSDs will be somewhat bottlenecked, though that's hardly a factor in the scenario detailed here.

⌄ *What is it – some sort of ninja throwing star?*

Guilty As Charged

I own a 2008 MacBook (bought a few years ago, second-hand) and it's stopped charging. I figured I just needed a new battery, but from what I'm reading online, it seems there's a possibility that the MacBook's charging circuitry might be the problem. Is there any way to tell? I don't want to buy a new battery only to find it doesn't help.

Klaus, Gmail

The charging circuitry is notoriously frail on early MacBooks (typically the 2006–2009, non-unibody models). Perhaps a new battery is all you need; perhaps a new battery will do nothing at all. Sadly, Klaus, the only way to find out is to actually fit one. Expect to pay around £15 – on eBay, as ever. You're after a battery suitable for the range of MacBooks carrying the model number A1181.

Buy from a seller with at least 99% positive feedback and no more than a handful of negative comments regarding batteries, then keep your fingers crossed. That's as much as you can do – buying a laptop battery is always a bit of a gamble unless you sign a loan agreement with your bank and buy direct from the laptop's manufacturer.

If the MacBook's charging circuitry has indeed bitten the dust, you could always send the new battery back (at your expense). By law, business sellers have to accept returns up to 14 days after the buyer takes receipt, and you don't need to give a reason.

A MacBook that's the best part of a decade old is probably uneconomical to repair (you'd need a replacement motherboard),

so in the worst case, you'll just have to use it via the mains until you're ready to buy something new (or new to you).

Be careful not to accidentally pull the cord out before saving important work – I know what that's like! Old Apple MagSafe chargers tend to come unplugged at the drop of a hat.

⌄ *Unfortunately, charging problems on some MacBooks aren't solved by fitting a new battery*

Crowdfunding Corner

Whether you like it or not, smart technology is the future. From smartphones to smart cars, we're already using it. What lengths can you take the smart label to, though? This week, two projects stretch it pretty far…

Hallam New York Smart Jacket

As the people of wealth and taste that we know you all to be, you probably own a smart jacket or two. We'd wager, however, that you don't own one like this – which is *smart* smart, in the sense of being connected to the wider Internet of Things and using the latest futuristic materials and technology.

Its features include practical details designed for modern living. These include a sleep shade, inflatable neck pillow, earphone pocket and built-in air vents; these sit alongside genuinely smart features like Bluetooth remote buttons, built-in GPS tracker, push notification LEDs, a built-in battery pack and more. Whatever you can imagine a smart jacket doing, this probably does it.

There are five basic styles to choose from – Hoodie, sweatshirt, varsity jacket, padded vest (body warmer) and wool. From that starting point, you can customise the colour and choose a cut based on your gender.

The basic smart versions of the jacket start at $179 (£136), a huge saving off the retail price of $289 (£220). If all goes to plan and the project meets its goal of $15,000 (seems very likely based on those numbers) then the jacket will start shipping in January 2017.

There's still plenty of time left to back, so why not check out the extensive list of features (over 30 in total) and try to imagine ever living without it.

URL: kck.st/2aUqfWp
Funding Ends: Tuesday, August 30th 2016

Perseus Smart Mirror

Named after the guy who slew Medusa by watching her reflection in his shield, the Perseus smart mirror gives your bedroom the futuristic accessory you always wanted but never imagined. So, what are we actually talking about? Well, there's the built-in HD camera, speakers, voice recognition microphone, social media updates and weather updates, calendar and news apps – basically everything you could imagine checking on your smartphone in the morning can be displayed on this mirror instead.

It's essentially a standard mirror with a tablet screen laid over the top instead of glass, so there are some choices you'll have to make to better fit in with your home. The unit comes with frames in seven different colours – gold, black, pink, copper, grey, blue and white – so you can choose the one that fits your décor best.

The project is aiming for a $100,000 target and, while it's only halfway there at time of writing, it still has weeks left to finish. As such, we're pretty confident it'll pass its target comfortably.

if you want in, you can probably still get one for the offer price of $249 (£189), which is $200 off its suggested retail price of $449 (£342). If that sounds steep it is, after all, essentially a tablet computer with a mirror built in, so its priced as such. it's futuristic to the point of looking like it came out of a sci-fi movie, though, and we're sure that it'll be worth the money.

URL: kck.st/2aE6Wx5
Funding Ends: Tuesday, September 20th 2016

Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week
ScreenToGif

This week, we create some clever animations

We've been playing around with some animated GIFs in recent weeks, making some of our own or manipulating what others have already created.

In that time, we've used a good few programs to help us achieve the result, but one of the best we've encountered is the extraordinarily clever ScreenToGif.

Developed by Nicke Manarin, ScreenToGif is a complete recording and editing program to help you create looped animations or video. You can include text, subtitles, title frames, borders, watermarks and drawings, as well as being able to crop, resize and clip out unwanted frames from your recording.

It's quite an impressive piece of coding and, what's more, it's free and open source.

Better GIFs
ScreenToGif can be found at **goo.gl/ ut3iMv**, with the latest version at 2.1. Once downloaded, all you need to do is run the executable (no installation needed), and you'll be presented with a simple UI with four main options: Recorder, Webcam, Board and Editor, as well as an options section.

The Recorder is where you can select a section of the screen to record a looped video. You just expand the overlay box over the section you want to record, increase or decrease the frames per second, and hit the record button to begin. Once you've got the captured feed, just click either the pause or stop button, and you'll be taken to the Editor section.

The Webcam option is fairly self-explanatory: if you have a webcam handy, then you can record a video and chop it down into sections to create your own personal GIFs.

The Board section is an interesting addition, allowing you to record a freehand drawing in a Paint-like environment that'll loop from beginning to end. Once you've hit the stop button again, you'll be taken to the editor to fine-tune the video.

Finally, the editor is where you'll end up, and from here you can add, delete, chop and change any of the individual frames or include any of the aforementioned effects to help make your animation stand out.

Considering the entire program is developed by a single person and is freely available, it's quite exceptional.

Conclusion
There's plenty to get your teeth into here, and it's fast become one of our most used programs, allowing us to create a cool retro-themed Manic Miner Micro Mart Spectrum loading animation, as well as a similar Happy Birthday theme along the same lines.

If you're in need of a new animation, video and GIF editor and creator, then we most certainly recommend using ScreenToGif.

Features At A Glance
- Record your screen and save directly to a GIF looped animation or a video.
- Pause and continue to record or start over by discard the recording.
- Move the window around to record what you want, and it stays on top.
- You can add text, subtitles, title frames, borders, watermarks, drawings, etc.
- Crop and resize.
- Remove frames that you don't want.
- Select a folder to save the file automatically or select one before encoding.
- Add the system cursor to your recording.
- Very small and portable (uses a settings file under the AppData folder) executable.

⌃ *The simplistic UI hides quite a complex program underneath*

⌃ *The editor is where you'll end up, and it's surprisingly powerful for such a small app*

⌃ *Obviously, this can't be animated on paper, but trust us, the effect is very cool*

Logging Off

Yahoo Inc. is one of those companies that grew rapidly in the past, and then ran out of steam. How it managed to take what was a major stake in the blossoming internet and flush it away over time is a long story, but not one for today.

Yahoo is in the process of being bought by Verizon, with a bid of $4.8 billion for a company that was once worth so much more. With this announcement, Yahoo CEO Marissa Mayer said the company had been radically changed under her tenure and that she "couldn't be more proud of the achievements to date."

Really? Wow. What about that time you bought Tumblr for $1.1 billion, and then wrote off first $230 million and then another $482 million of that acquisition three years later?

Obviously, she's not as proud about that bit, because she didn't mention that at all, oddly enough.

She also passed over the part where four years prior to her taking the reins in 2012, Yahoo! was on the very cusp of being bought by Microsoft.

Steve Ballmer really wanted Yahoo to fight Google, and after starting out waving $35 billion in their faces, eventually offered a cool $44.6 billion for its business.

Hilariously, the board of Yahoo rejected this offer, stating that they couldn't accept a number that "substantially undervalues" the company and was not in the interest of its shareholders. And eight years later, the shareholders get less than 11% of that amount. Steve Ballmer must chuckle to himself every time he realises the bullet he dodged there, given how Yahoo has spiralled since.

I guess that much reduced value was partly through the efforts of Marissa Mayer, who in her own words, "streamlined and modernised every aspect of our consumer products and dramatically improved our advertiser products. We've laid incredibly solid groundwork and the sale gives us the opportunity to build on that momentum."

For her undeniable impact on making Yahoo such a success, she's received severance of $57 million and has stated she wishes to stick around after Verizon takes control.

Whatever she'd like, Verizon seemed less openly enthusiastic about her remaining, "Verizon had not yet made a decision about what role, if any, Mayer would have after the deal closes."

YAHOO!

If I was an egotistical CEO of a company brand that people used to use, I'd take that lack of future endorsement as a hint, Marissa.

There's lots about this deal that doesn't make much sense, but mostly what Verizon thinks that it will get from it other than a $4.8 billion hole in its accounts. The answer to that is hidden under a horribly failed online advertising business and a substantial stake in Chinese e-commerce powerhouse Alibaba – and that is worth something.

But what Verizon is expecting is to use Yahoo and that other dead duck it bought recently, AOL, to plunder the US mobile market. What it will try to do is to sell data services through Yahoo and AOL, and use its mobile network to advantage them by excluding this traffic from its customer data packages.

At least it will if the Federal Communications Commission doesn't decide that's bending net neutrality rules past breaking point and scuppers its masterplan from the outset.

Taking on Facebook and Google is exactly how Yahoo ended up being worth so little.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Advertisement, **8** HP Mini, **9** Googol, **10** Egghead, **12** Cheat, **14** Lamer, **16** Grandee, **19** Virgil, **20** Cosine, **22** Google Bombing.
Down: 1 LDAP, **2** Zenith, **3** Ethical, **4** Usage, **5** Smooth, **6** Innovate, **11** Graviton, **13** Proctor, **15** Engage, **17** Naseby, **18** ALTER, **21** NAND.

THIS WEEK'S CROSSWORD

Across
7 An estimate based on knowledge and experience, and therefore likely to be correct. (8,5)
8 A nephew of Arthur and one of the knights of the Round Table (6)
9 XX (6)
10 A type of Linux malware that's hard to detect and which can download files to user systems. (7)
12 A piece of fiction that narrates a chain of related events. (5)
14 One of the equal parts into which a company's capital is divided, entitling the holder to a proportion of the profits. (5)
16 The science of applying tactile sensation and control to interaction with computer applications. (7)
19 An item in a list displayed at the beginning or end of a film or television programme, acknowledging a contributor's role. (6)
20 Egyptian sun god; supreme god of the universe; principal deity during Theban supremacy. (4-2)
22 What Mavis Beacon does. (7,6)

Down
1 The content of cognition? (4)
2 A size of book page that results from folding each printed sheet into eight leaves (16 pages). (6)
3 An operational mode in which the power is switched on but the appliance is not actually functioning. (7)
4 Text that when parsed is meant to be interpreted as containing no XML markup. (5)
5 Softly bright or radiant. (6)
6 Confined to and understandable by only an enlightened inner circle. (8)
11 A system for connecting a number of computer systems to form a local area network. (8)
13 A form of rummy using two decks of cards and four jokers. (7)
15 Censor or obscure part of a text for legal or security purposes. (6)
17 Organisation of performers and associated personnel. (6)
18 And what follows (used in page references). (2,3)
21 The dimensionality of an array. (4)
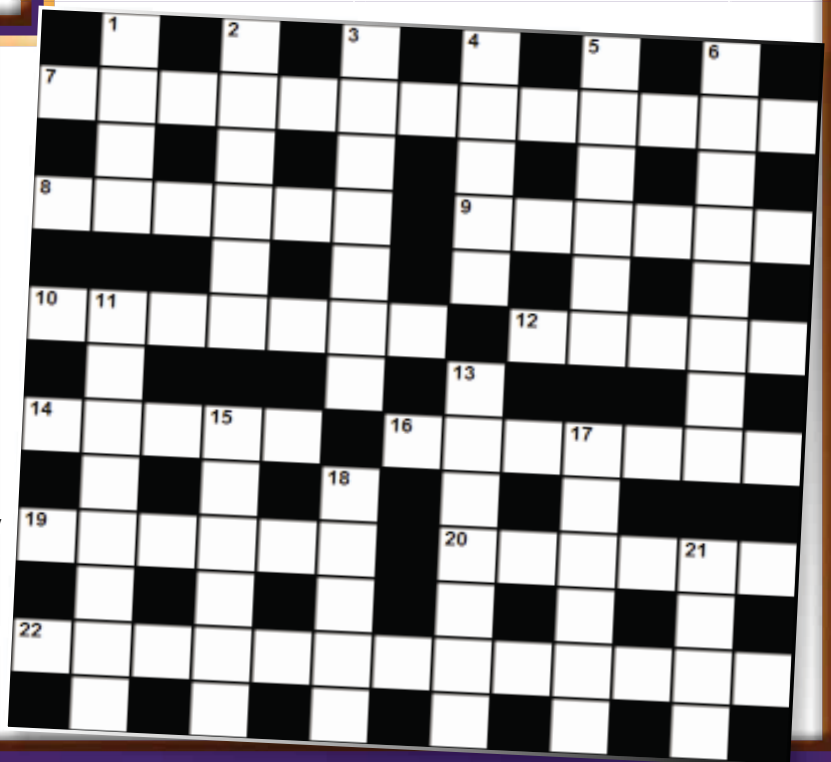
Top **5** Gaming Fads

From gesture controls to virtual monsters…

1 Nintendo Wii

Released in 2006, the Wii was a daring new approach to gaming. Rather than fighting with Microsoft and Sony to compete on pure polygon-pushing power, Nintendo instead chose to couple a low-powered console with a novel new control system. Instead of asking you to sit down and twiddle analogue sticks with your thumbs, the Wii urged you to stand up, to swing your arms about and to generally make a bit of a twit of yourself.

It was a huge success, as we now know, but ultimately, it was a short-lived craze. Yes, it got non-gamers interested in playing games, but pretty soon it became that thing you only got out at Christmas. Casual players got bored with it, and hard-core gamers realised, on reflection, that they actually rather liked sitting down twiddling analogue sticks with their thumbs.

2 World War 2 Shooters

Call of Duty and *Call of Duty 2* are undoubtedly two of the best and most well known WW2 first-person shooters of all time, but they were preceded by the *Medal of Honor* games, which first saw light in 1999. However, around the time when the first *CoD* game came out, there began a few years when it seemed like there was a new addition to the genre almost every week.

As well as the aforementioned series, there were also the *Battlefield* games, the *Brothers in Arms* titles, a few *Red Orchestra* games, loads of *Battlestrike* instalments, and many more.

Of course, eventually, the *Call of Duty* series brought things into the present with *Modern Warfare*, but one fad soon led to another…

3 Modern Shooters

First-person shooters set in the present aren't a new idea. Soldiers use guns, so why wouldn't they be the inspiration for videogames that involve shooting? What's funny, though, is how major developers and publishers suddenly began falling over themselves to release modern military shooters after *the success of* Call of Duty 4: Modern Warfare in 2007.

The *Battlefield* series, among others, had already moved to a modern-day setting in 2005, but when players went crazy for *CoD4* and then *Call of Duty: Modern Warfare 2*, even the *Medal of Honor* series left its WW2 roots behind with its 2010 reboot.

Lots of similar games followed, many of which included the now rather tiresome killstreak rewards used so extensively in the *CoD* series.

4 Vs Fighting Games

The beat-'em-up genre was already well established before 1992, with players already being spoilt with various scrolling brawlers. But this was the year that Capcom released the Super NES port of its hugely successful *Street Fighter 2* arcade game.

This game was huge, and it soon appeared on other home consoles. And then suddenly the home console market was swamped with even more player-vs-player fighting games. There was *Mortal Kombat*, of course, but also things like *Clayfighters*, *Tekken*, *Rise of the Robots*, *Soul Edge*, *Killer Instinct*, *Primal Rage* and many more. Some were great, some were awful, but for a while, it seemed like they were all anyone was interested in making.

5 Pokemon Go

Augmented reality has been with us for a quite a few years now, but it hasn't really taken off. With *Pokemon Go*, however, an app developer has managed to get millions off people off their sofas, with a game that combines the real world with virtual creatures and objects.

Nintendo may have said it's not making huge amounts of money, but there's no denying that the game has captured the public's imagination. Don't be surprised, then, if the next year or so sees a spate of AR games being released, in the hope of getting a slice of this potentially lucrative pie. **mm**